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- stress scenarios
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- common user network control
- system control

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report, the first of four required under two tasks, documents the model of the European Defense Communications System in the mid 1980 time frame and presents a set of stress scenarios from which requirements for network and traffic controls will be derived. The scenarios include isolated and inter-dependent events of failures, unusual traffic conditions and other system degradations. The report includes addressal of the DCS AUTOSEVOCOM II network which is no longer valid.

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SECTION I. INTRODUCTION

This is the first Technical report for the System Control for the Transitional DCS study. The purpose of this study is to define the functional requirements for system wide real time system control applicable to the Defense Communications System in the mid 1980's. In order to define these requirements, the study is following a logical progression of tasks, each one building upon the results of all of the previous tasks. The order of the tasks is as follows:

- Generate a deployment model - a model of the DCS deployment in the mid 80's which removes planning uncertainties but which accounts for major peculiarities of the DCS. This model provides a firm system design against which we can develop and test system control concepts.

- Generate stress scenarios - a set of system stress situations which need system wide control to alleviate the stress. Created by analyzing the deployment model to determine possible stress situations.

- Select parameters - analyze the stress scenarios with respect to the capabilities of the subsystem equipment to determine what parameters indicative of the stress are available.

- Develop performance and status assessment, stress detection and isolation techniques - develop the algorithms, data structures, and displays necessary to use the parameters to detect and isolate stresses of the types described in the stress scenarios.

- Detail the requirements - generate functional flow charts of the performance and status assessment algorithms, analyze the communications flows required to support the algorithms, and identify and estimate the size/cost of any hardware/software additions or modifications required to support performance and status assessment stress detection and isolation.

- Develop control algorithms - determine a set of practical control responses which will alleviate the system stresses of the stress scenarios. Analyze the response time of the control system and determine change in parameter acquisition required to implement the controls.

- Quantify the benefits of controls - compare the operation of the DCS in terms of performance measures, availability to critical subscribers and manning requirements with and without overall control.

- Determine implementation requirements - specify hardware/software changes and interface requirements, and estimate their size and cost, for implementing the control algorithms.

- Identify areas needing further effort.

This report covers the first two items - the deployment model and the stress scenarios. There will be three other reports covering the following subjects:

Technical Report #2 - Parameter selection, Performance and Status Assessment Stress Detection and Isolation Techniques, and details of their implementation requirements.

Technical Report #3 - Control algorithm development, performance analysis.

Final Report - Summary of all the tasks, plus details on the control implementation requirements and recommendations for future studies.

SECTION II. DEPLOYMENT MODEL

2.1 Purpose of the Deployment Model

The purpose of the deployment model is to clearly document our assumptions regarding the characteristics of the DCS in the mid 1980's. The model also provides a simplified representation which emphasizes those aspects of the DCS affecting the development of system control techniques.

The time frame for this study is the mid 1980's. Since this is several years in the future, there is still some planning activity on going which affects the characteristics of the system studied by this study. The deployment model is a mechanism to make this study independent of these planning activities. It represents the best understanding of current plans at the initiation of the study, and will be used throughout the study as the representation of the DCS.

The Deployment model is the basis for the entire study. The stress scenarios are situations involving failures, unusual traffic conditions, or other conditions of system degradation which can exist in the deployment model. Development of system requirements is in turn based on the stress scenarios.

2.2 Assumptions

2.2.1 Time Frame--The deployment model is set in the 1982-1985 time frame. During this period, the most dramatic changes planned for the DCS will be nearing completion. The common user switched networks will be upgraded to the stage II systems (AUTOVON II, AUTOSEVOCOM II, AUTODIN II). The final phase of the DEB will be installed, the Pacific Digitalization will be underway, and the Phase III DSCS Satellite will be in use. The DCS will have transitioned from a predominantly analog to a predominantly digital system. Since this study is addressing system control for the new subsystems, the 1982-85 time frame is the earliest time frame applicable.

2.2.2 Geographical Area

The deployment model is a respresentaion of the European backbone. The model uses actual locations and contains a representation of the major features of the European backbone. This approach is used rather than a purely abstract modeling approach because an abstract model could not highlight the system control problems caused by the peculiarities of the DCS.

The European backbone was chosen because it is at least as complex as any other segment of the DCS, and it contains examples of every type of subsystem used in the DCS. The European area is reflective of user and mission objectives world wide.

System control requirements obtained by studying the European area can be directly extended and applied to other segments of the DCS. Therefore, in order to limit the scope of the deployment model to manageable size, the European backbone was chosen for the model.

2.2.3 Communications Equipment--The communications equipment assumed is consistent with the basic time frame assumption.

Line of sight microwave radios are assumed to be DRAMA type digital radios. First level multiplexing is assumed to be based on the T1 signal format, with first and second level multiplexing according to DRAMA type specifications.

Digital tropo scatter equipment is assumed on those links for which the DEB IV upgrade plan specifies digital tropo.

All AUTOVON/AUTOSEVOCOM switches are assumed to be AN/TTC-39 switches. AUTOSEVOCOM subscribers are concentrated behind SB-3865 unit level switches (ULS).

AUTODIN II switches are assumed to be equivalent to the packet switching node currently specified for CONUS installation.

2.2.4 Performance Monitoring Equipment--The transmission system is assumed to be monitored by ATEC equipment as specified in the October 1977 ESD 10000 Specification, and all sites are assumed to be suitably instrumented to perform their monitoring function This assumption is based on the current ongoing LRIP procurement and the DCA ATEC Management Engineering Plan of October 1976.

Because of the capability of this equipment, other monitoring equipment such as the Fault Alarm Status Reporting equipment manufactured by Harvey Hubble Co. will either be phased out or integrated into ATEC as ATEC is deployed. The performance assessment, control actions and information flow currently specified in the ESD 10000 is assumed to be the pre-existing transmission system control that this study is based on.

2.3 Deployment Model Data

The deployment model consists of five sections, as follows:

- European Backbone Topology and link overlay
- Common user network connectivity
- Critical User Deployment
- ATEC Overlay
- System Segment Detail

Each section consists of charts and/or tables covering the information of that section.

2.3.1 European Backbone Topology--This section addresses the 1982-85 Europe DCS Backbone Topology. Spurs and tails are omitted to maintain simplicity and emphasize backbone topology, however when discussing any particular user it is assumed that the user circuit may traverse a tail circuit not shown on our charts.

The European DCS backbone will consist of terrestrial and satellite communication links, connecting the United Kingdom, Belgium, Germany, Italy, and Spain.

As shown in Figure 2-1, the UK portion of the backbone consists of all digital transmission links from Hillingdon, England, to Martlesham Heath, England, and from Hillingdon to Swingate, England. DSCS trunking interface is provided by the Croughton, England, satellite terminal. AUTOVON switches are located at Hillingdon and Martlesham Heath, and an AUTODIN switch is located at Croughton. UK-continent connectivity is provided at Swingate and Martlesham Heath. CONUS-UK connectivity is provided by the Hillingdon Gateway AUTOVON switch, Croughton AUTODIN switch, and Croughton satellite terminal. Insets 1 and 2 of Figure 2-1 provides the CONUS-Europe and Intra-Europe satellite connectivity.

As shown, UK - Germany connectivity is provided by two paths; Martlesham Heath to Feldberg, Germany, and Swingate to Schoenfeld, Germany. The backbone consists of all digital transmission links as shown. The Martlesham Heath - Feldberg portion is digital tropo and diffraction equipment. All other links are line-of-sight microwave. Germany contains AUTOVON switches at Schoenfeld, Feldberg, Donnersberg, and Langerkopf. Feldberg is the Gateway Switch with CONUS connectivity. DSCS trunking interface is provided by the Landsthul satellite terminal (see inserts 1 and 2 of Figure 2-1). An AUTODIN switch is located at Pirmasens. Germany - Italy connectivity is provided via Zugspitze to Cima Gallina, Italy, over the DEB I system.

Germany - Italy connectivity is provided by a simple thin line series of links (DEB I). Coltano North consists of all digital transmission links. Coltano South consists of the upgraded 486L tropo equipment (AN/FRC-96). A microwave feeder is present at Mt. Vergine for Naples and DSCS connectivity. AUTOVON switches are located at Coltano and Mt. Vergine. An AUTODIN switch is located at Coltano. DSCS trunking interfaces are provided by the Coltano and Naples satellite terminals. The

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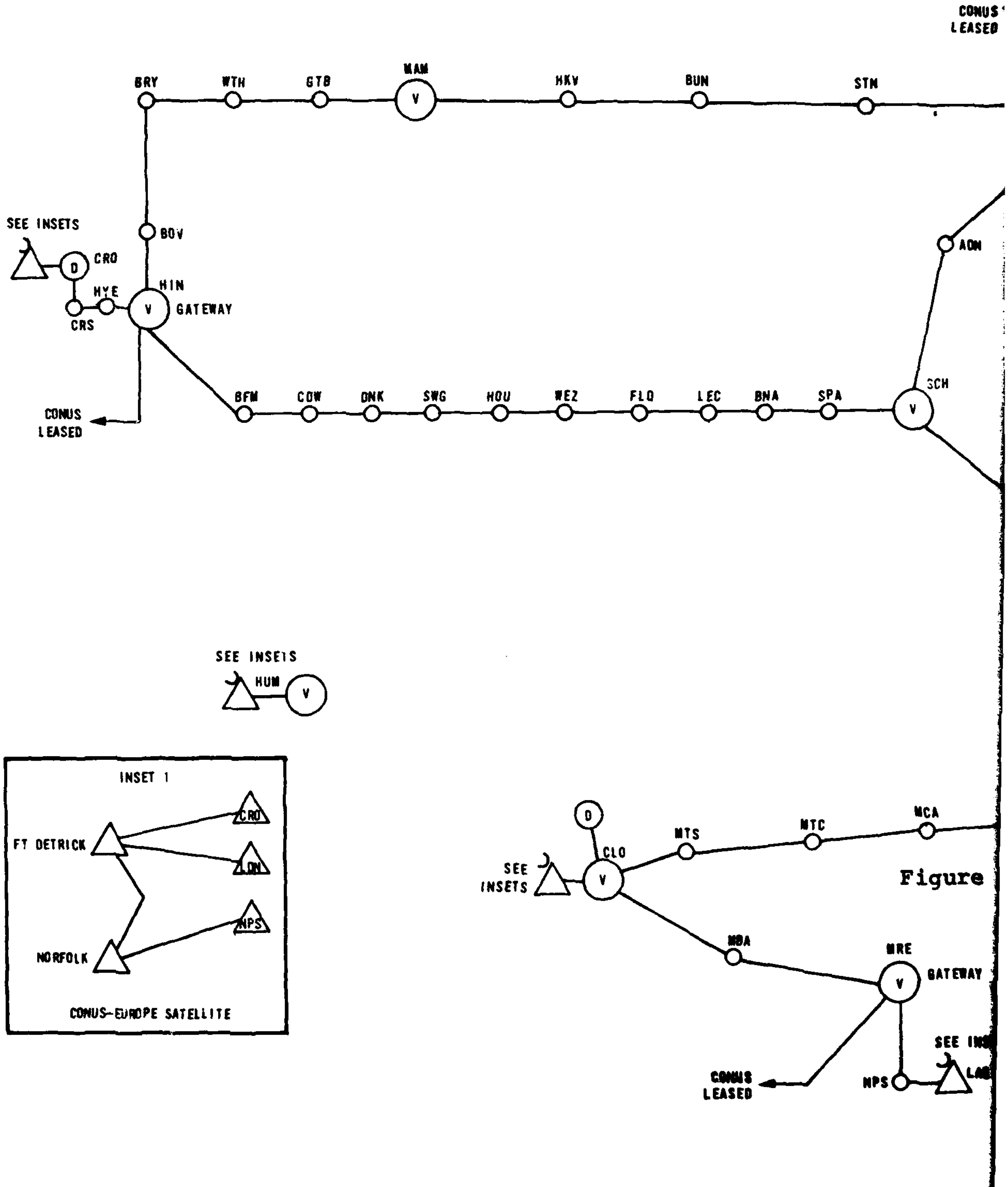
DON = DONNERSBERG, GER.
FEL = FELDBERG, GER.

FLQ = FLOBECQ, BEL.
FZM = FRIOLZHEIM, GER.
GTB = GREAT BROMLEY, U.K.
HDG = HEIDELBERG, GER.
HDM = HEIDENHIEM, GER.
HIN = HILLINGDON, U.K.
HKV = HOEK VAN HOLLAND
HOU = HOUTEM, BEL.
HST = HOHENSTADT, GER.
HUM = HUMOSA, SP.



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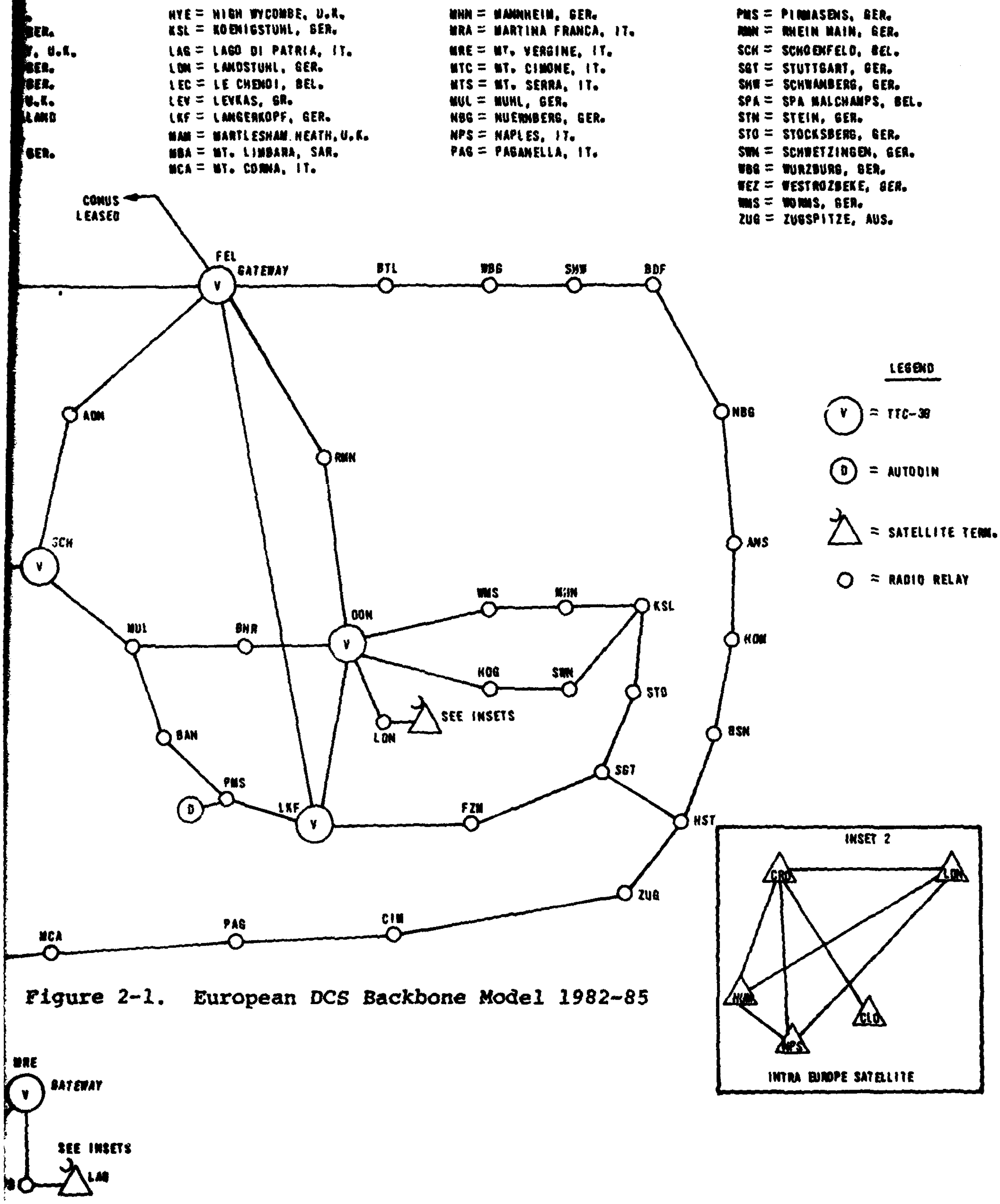

Figure 2-1. European DCS Backbone Model 1982-85

backbone terminates at Italy for the purposes of this model, although users in Greece and Turkey have access circuits to the backbone there.

Connectivity from Spain to UK, Germany, Italy, and Greece, is provided by DSCS satellite. Not shown in Figure 2-1 is the Telpak connectivity to UK. An AUTOVON switch and satellite terminal is lcoated at Humosa, Spain.

Figure 2-2 shows the radio link overlay to the backbone topology. This overlay provides the detailed information about the individual links, of the following types:

- Link distance
- Equipment class-line of sight, tropo, or diffraction
- Equipment type if known

Line of sight microwave radios are called "DCS radio". This means that some type of digital radio is used on this link. This was done to remove the remaining planning uncertainties in the deployment of radio equipments.

2.3.2 <u>Common User Network Connectivity</u>--The connectivity of the common user networks (AUTOVON/AUTOSEVOCOM II and AUTODIN II) is shown in Figure 2-3. This network connectivity is based on the latest planning information available. This information is the 32 KB hybrid TENLEY alternative design for AUTOSEVOCOM II. No associated upgrade plan for AUTOVON is available, but the current AUTOVON design and the 32 KB hybrid TENLEY alternative can be rationalized to provide a model network.

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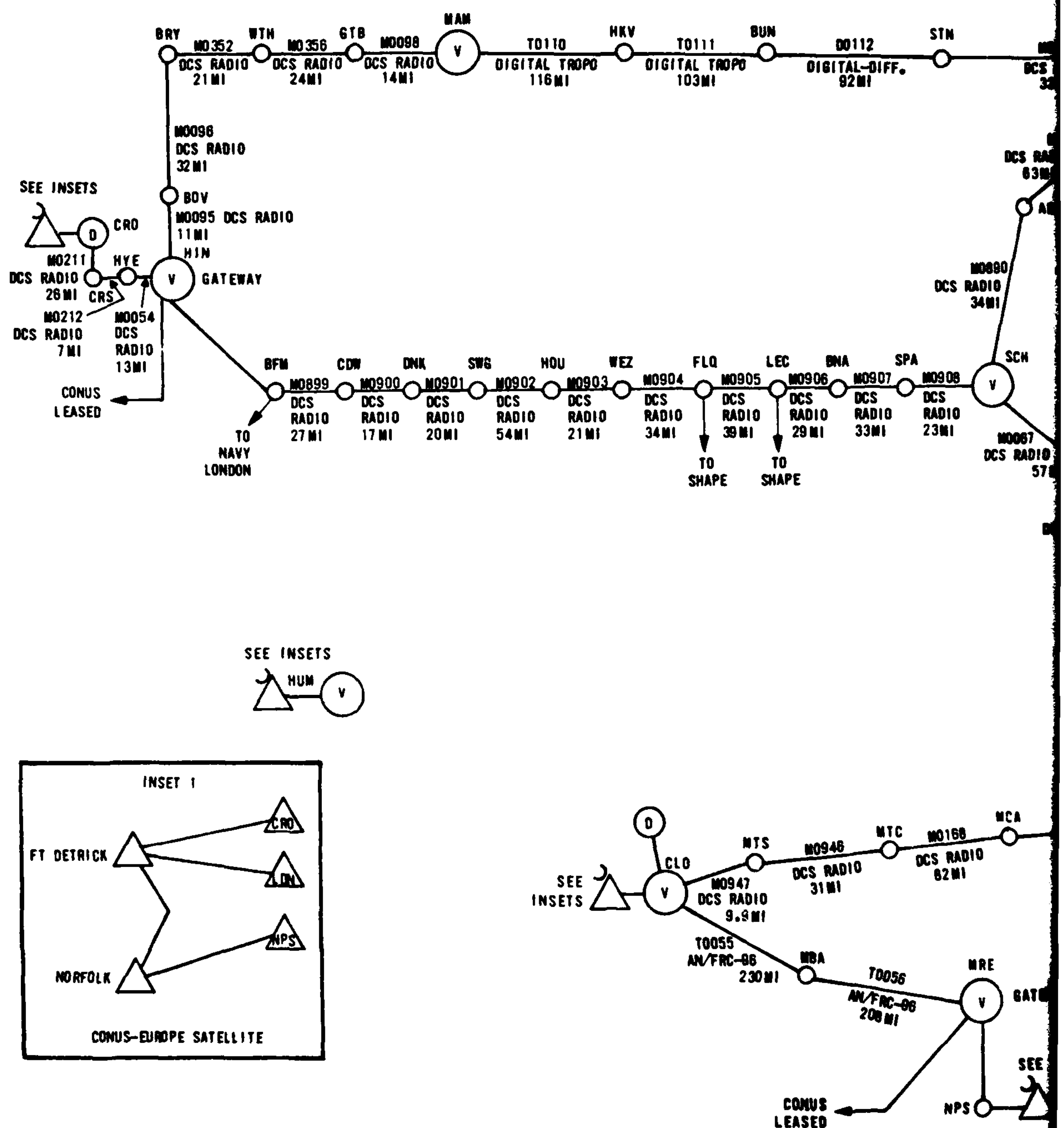

...G, BEL.
...HEIM, GER.
... BROMLEY, U.K.
...BERG, GER.
...HIEM, GER.
...NGDON, U.K.
...VAN HOLLAND
..., BEL.
...STADT, GER.
...A, SP.

HYE = HIGH WYCOMBE, U.K.
KSL = KOENIGSTUHL, GER.
LAG = LAGO DI PATRIA, IT.
LDN = LANDSTUHL, GER.
LEC = LE CHENOI, BEL.
LEV = LEVKAS, GR.
LKF = LANGERKOPF, GER.
MAM = MARTLESHAM HEATH, U.K.
MBA = MT. LIMBARA, SAR.
MCA = MT. CORNA, IT.

MHN = MANNHEIM, GER.
MRA = MARTINA FRANCA, IT.
MRE = MT. VERGINE, IT.
MTC = MT. CIMONE, IT.
MTS = MT. SERRA, IT.
MUL = MUHL, GER.
NBG = NUERNBERG, GER.
NPS = NAPLES, IT.
PAG = PAGANELLA, IT.

PMS = PIRMASENS, GER.
RMN = RHEIN MAIN, GER.
SCH = SCHOENFELD, BEL.
SGT = STUTTGART, GER.
SHW = SCHWANBERG, GER.
SPA = SPA MALCHAMPS, BEL.
STN = STEIN, GER.
STO = STOCKSBERG, GER.
SWN = SCHWETZINGEN, GER.
WBG = WURZBURG, GER.
WEZ = WESTROZBEKE, GER.
WMS = WORMS, GER.
ZUG = ZUGSPITZE, AUS.

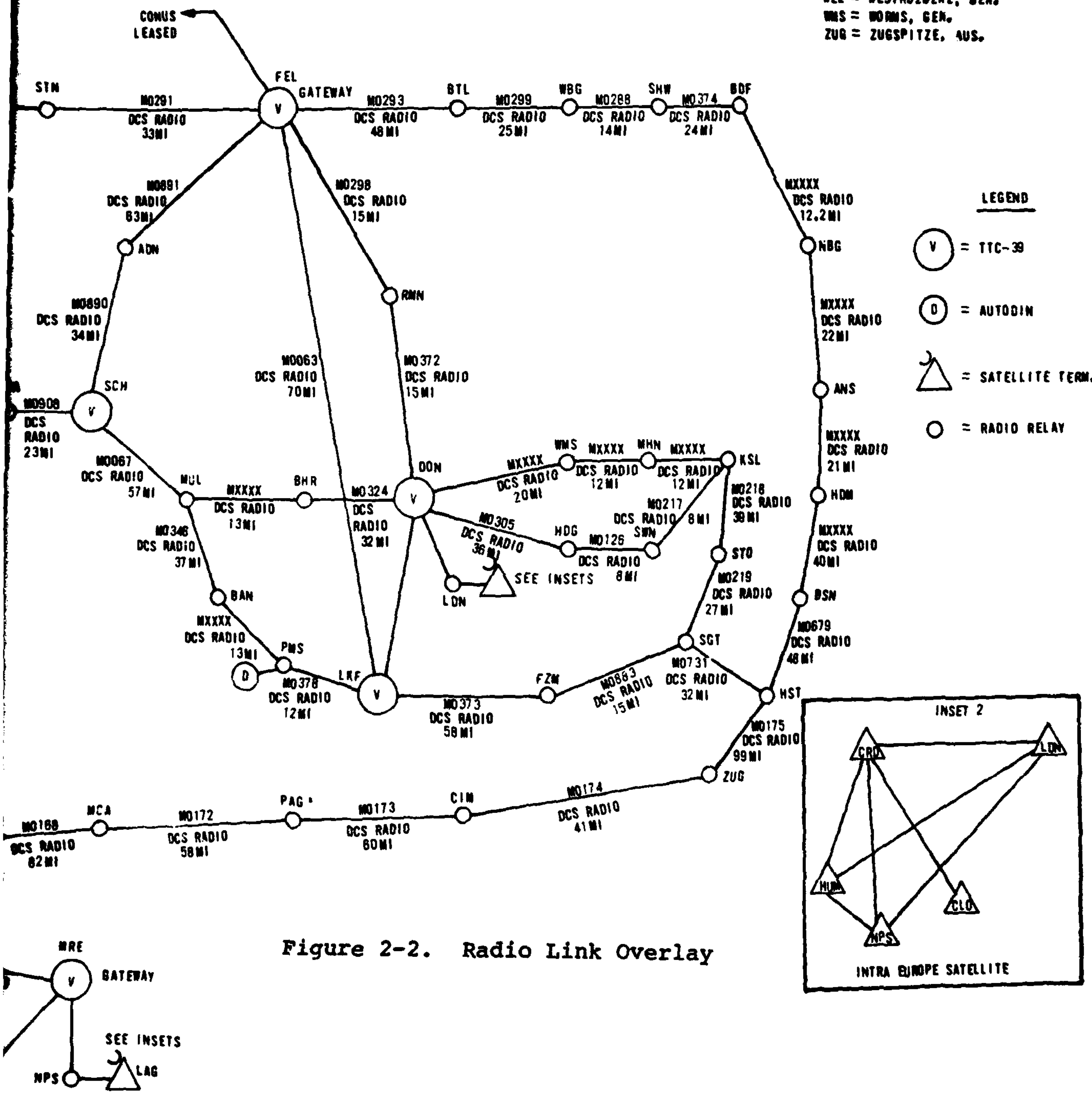

Figure 2-2. Radio Link Overlay

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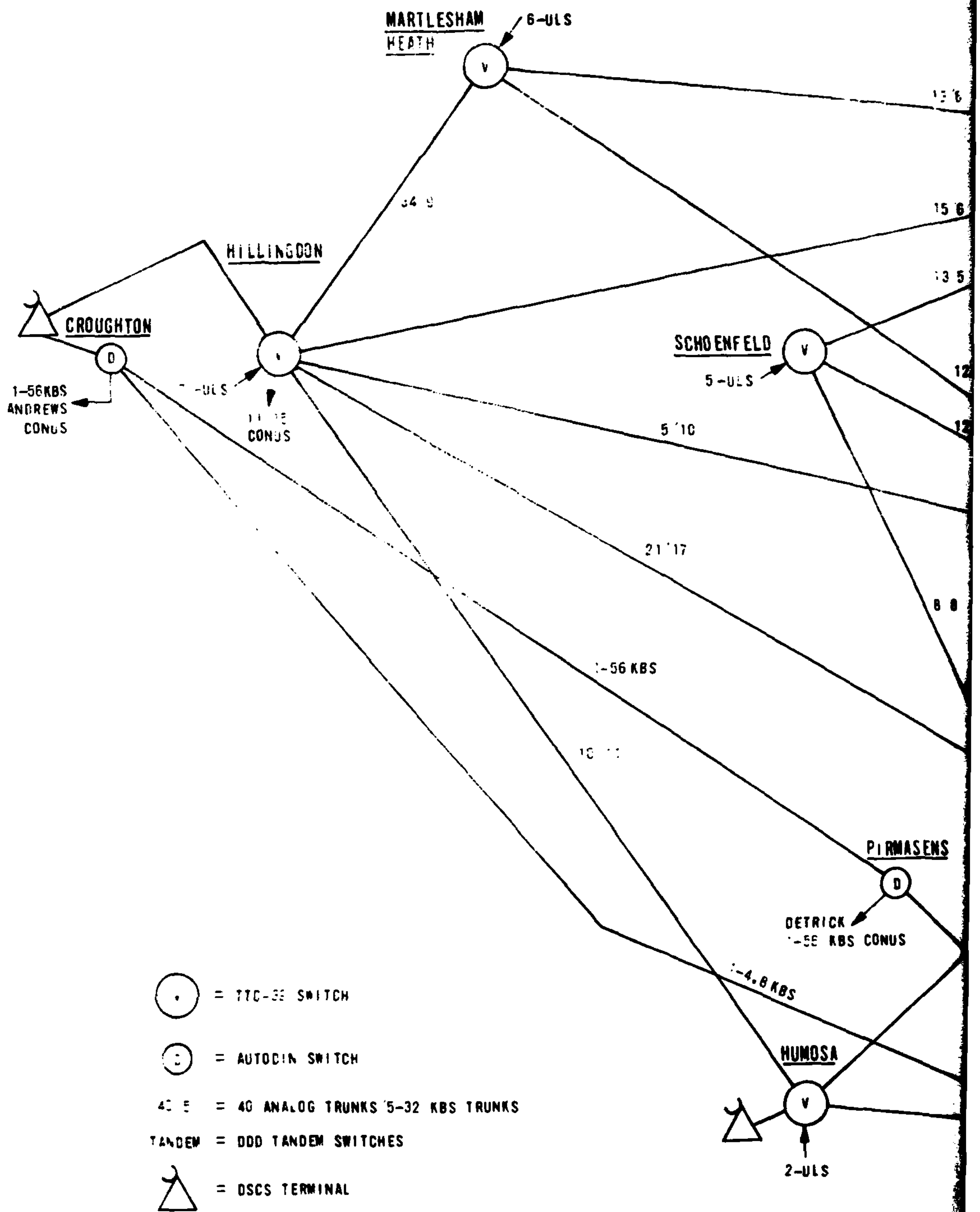
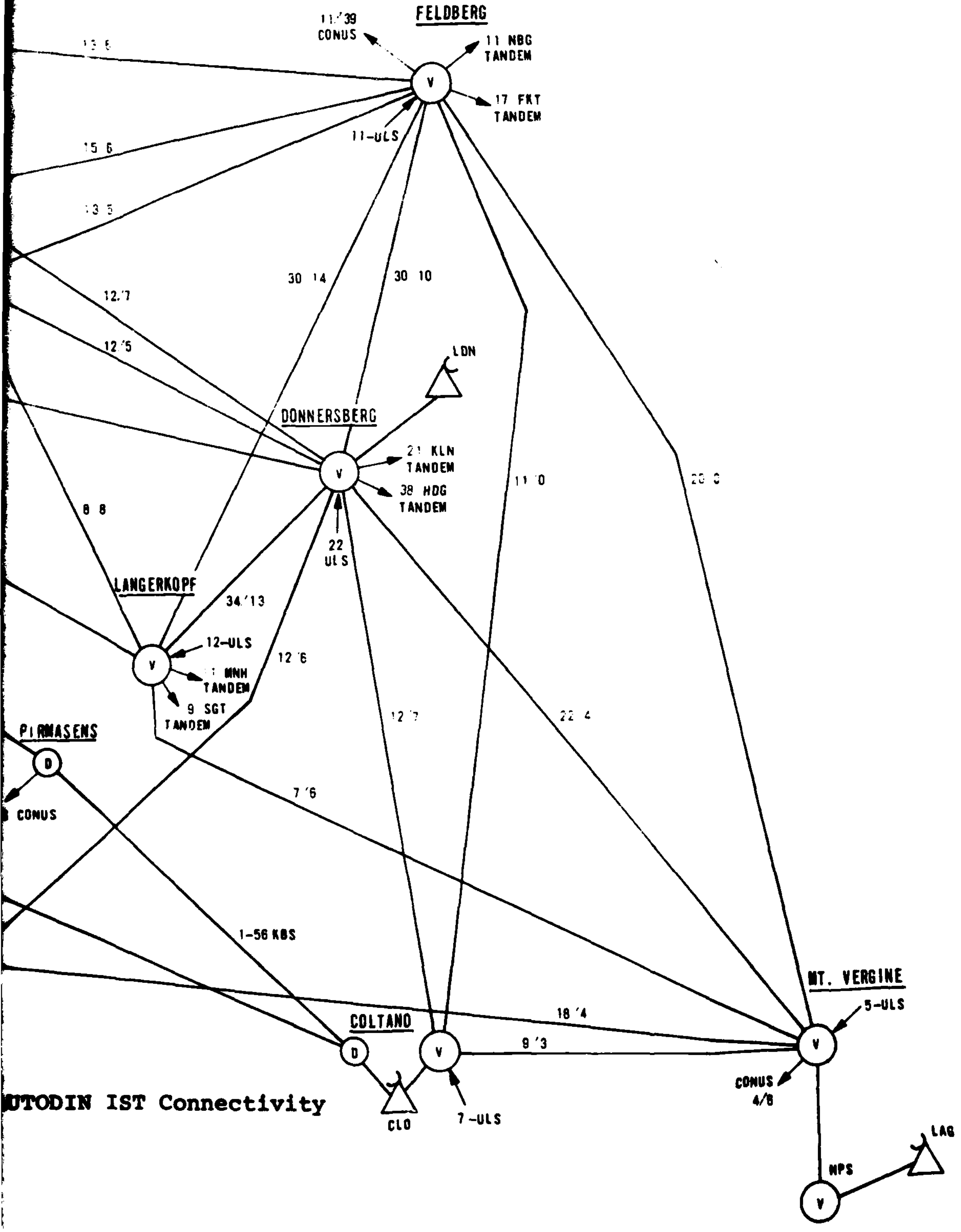


Figure 2-3. European AUTOVON-AUTODIN



UTODIN IST Connectivity

2

The primary differences between the 32 KB hybrid alternative and the current AUTOVON are the following:

- Elimination of the current Mt. Pateras AUTOVON switch
- The use of Langerkopf as a tandem switch between Hillingdon, England and Mt. Vergine, Italy
- Extensive additional connectivity

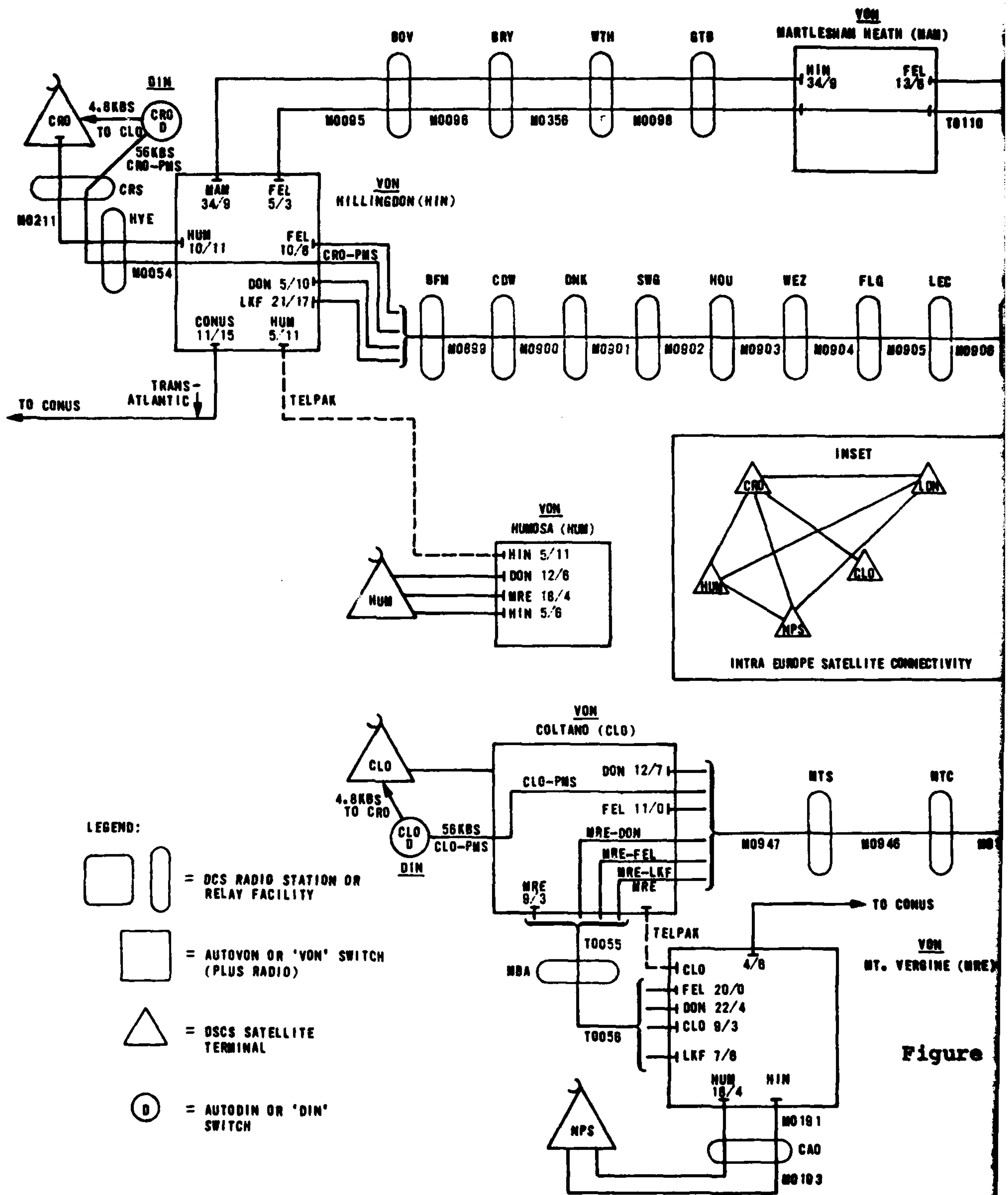
The connectivity in the deployment model was obtained by terminating the current Donnersberg - Mt. Pateras truck at Mt. Vergine, and terminating the current Hillingdon - Mt. Vergine trunk at Langerkopf from both ends. Other than these changes, the intra European analog connectivity remains unchanged from current AUTOVON. The digital connectivity was obtained by combining trunks from the 32Kb hybrid design such that the topology was identical to the analog topology derived above. Trans-atlantic trunking for both analog and digital is taken directly from the 32Kb hybrid TENLEY alternative.

The trunk capacities are tabulated in Table 2-I. Figure 2-4 shows how the trunks are routed on the transmission system backbone.

2.3.3 Critical User Deployment--The critical user deployment topology is shown in Figure 2-5. The topology shown does not constitute a complete or actual list of DCS users of the 1982-85 European DCS, but is representative of key or critical users. The selection was based on high precedence traffic estimates, command structures and elements, and mission objectives. Critical users selected for this study fall into one or more of the following categories:

Table 2-I
AUTOVON/AUTOSEVOCOM TRUNK GROUP INFORMATION

	CONNECTED SWITCHES			CAPACITIES	
Trunk Group Number	Number (Node) 1	2	Name 1 - 2	Analog Trunks	Digital Trunks
1	1	2	CON - HIN	11	15
2	1	5	CON - FEL	11	39
3	1	9	CON - MRE	4	6
4	2	5	HIN - FEL	15	6
5	2	3	HIN - MAM	34	9
6	2	7	HIN - LKF	21	17
7	2	6	HIN - DON	5	10
8	2	10	HIN - HUM	10	11
9	3	5	MAM - FEL	13	6
10	3	6	MAM - DON	12	7
11	4	5	SCH - FEL	13	5
12	4	6	SCH - DON	12	5
13	4	7	SCH - LKF	8	8
14	5	9	FEL - MRE	20	0
15	4	5	FEL - DON	30	10
16	5	7	FEL - LKF	30	14
17	5	8	FEL - CLO	11	0
18	6	9	DON - MRE	22	4
19	6	7	DON - LKF	34	13
20	6	8	DON - CLO	12	7
21	6	10	DON - HUM	12	6
22	7	9	LKF - MRE	7	6
23	8	9	CLO - MRE	9	3
24	9	10	MRE - HUM	18	4



VON
MARTLESHAM HEATH (MAM)
BOV
BRY
WTH
STB
HIN 34/9
FEL 13/6
M0095
M0096
M0356
M0098
T0110
DIN
CRO
4.8KBS TO CLO
CRO D
56KBS CRO-PMS
CRS
M0211
HYE
M0054
MAM 34/9
FEL 5/3
VON
HILLINGDON (HIN)
HUM 10/11
FEL 10/6
CRO-PMS
DON 5/10
LKF 21/17
CONUS 11/15
HUM 5/11
BFM
CDW
DNK
SWG
HOU
WEZ
FLQ
LEC
M0899
M0900
M0901
M0902
M0903
M0904
M0905
M0906
TO CONUS
TRANS-ATLANTIC
TELPAK
INSET
CRO
LDN
CLO
HUM
NPS
INTRA EUROPE SATELLITE CONNECTIVITY
VON
HUMOSA (HUM)
HIN 5/11
DON 12/6
MRE 18/4
HIN 5/6
HUM
VON
COLTANO (CLO)
CLO
CLO-PMS
DON 12/7
FEL 11/0
MRE-DON
MRE-FEL
MRE-LKF
MRE
MRE 9/3
4.8KBS TO CRO
CLO D
56KBS CLO-PMS
DIN
MTS
MTC
M0947
M0946
LEGEND:
= DCS RADIO STATION OR RELAY FACILITY
= AUTOVON OR 'VON' SWITCH (PLUS RADIO)
= DSCS SATELLITE TERMINAL
D
= AUTODIN OR 'DIN' SWITCH
TO CONUS
T0055
TELPAK
MBA
CLO
4/6
VON
MT. VERGINE (MRE)
FEL 20/0
DON 22/4
CLO 9/3
LKF 7/6
T0056
HUM 18/4
HIN
M0191
CAO
M0193
NPS

Figure

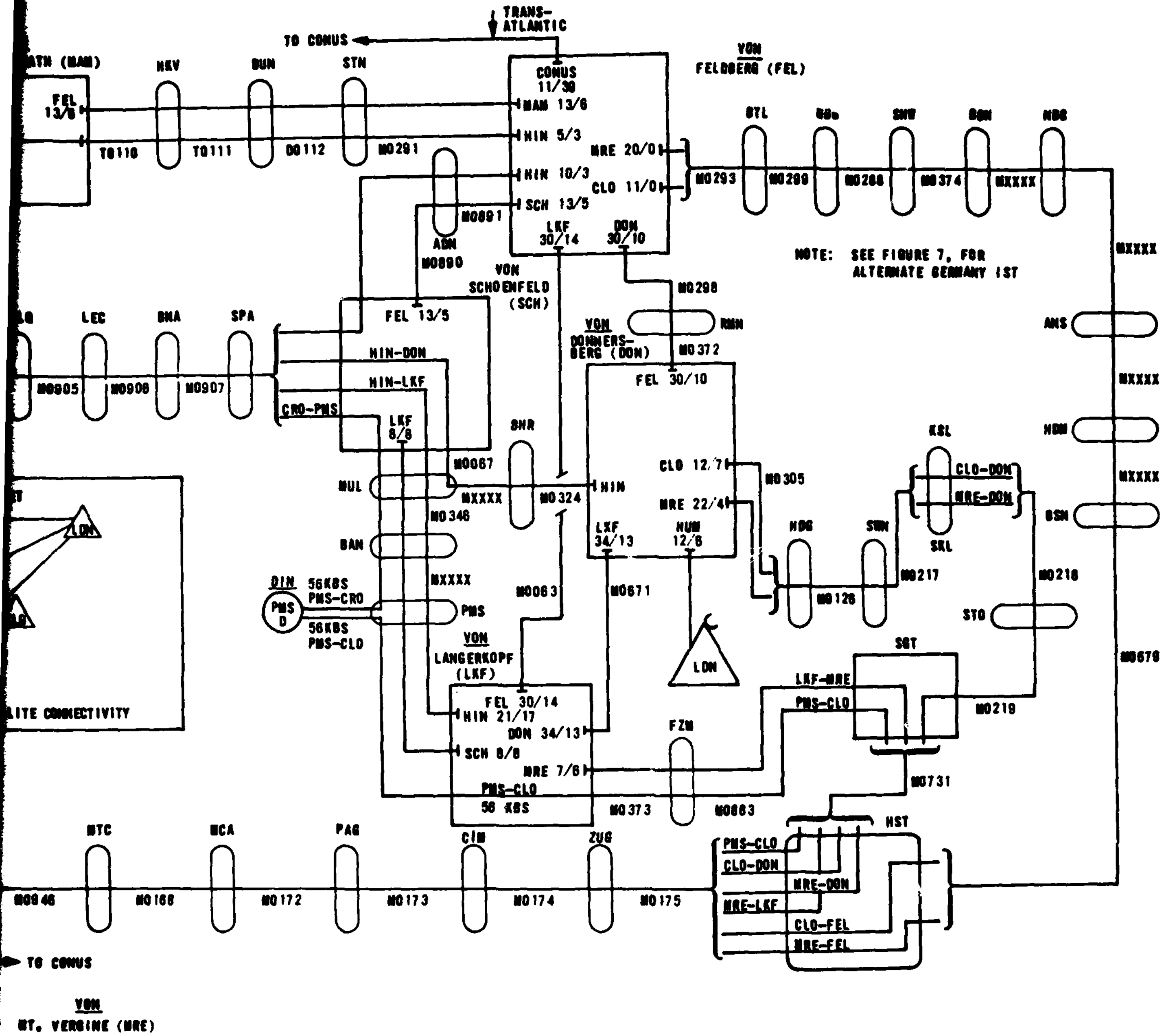


Figure 2-4. AUTOVON-AUTODIN IST Backbone Overlay

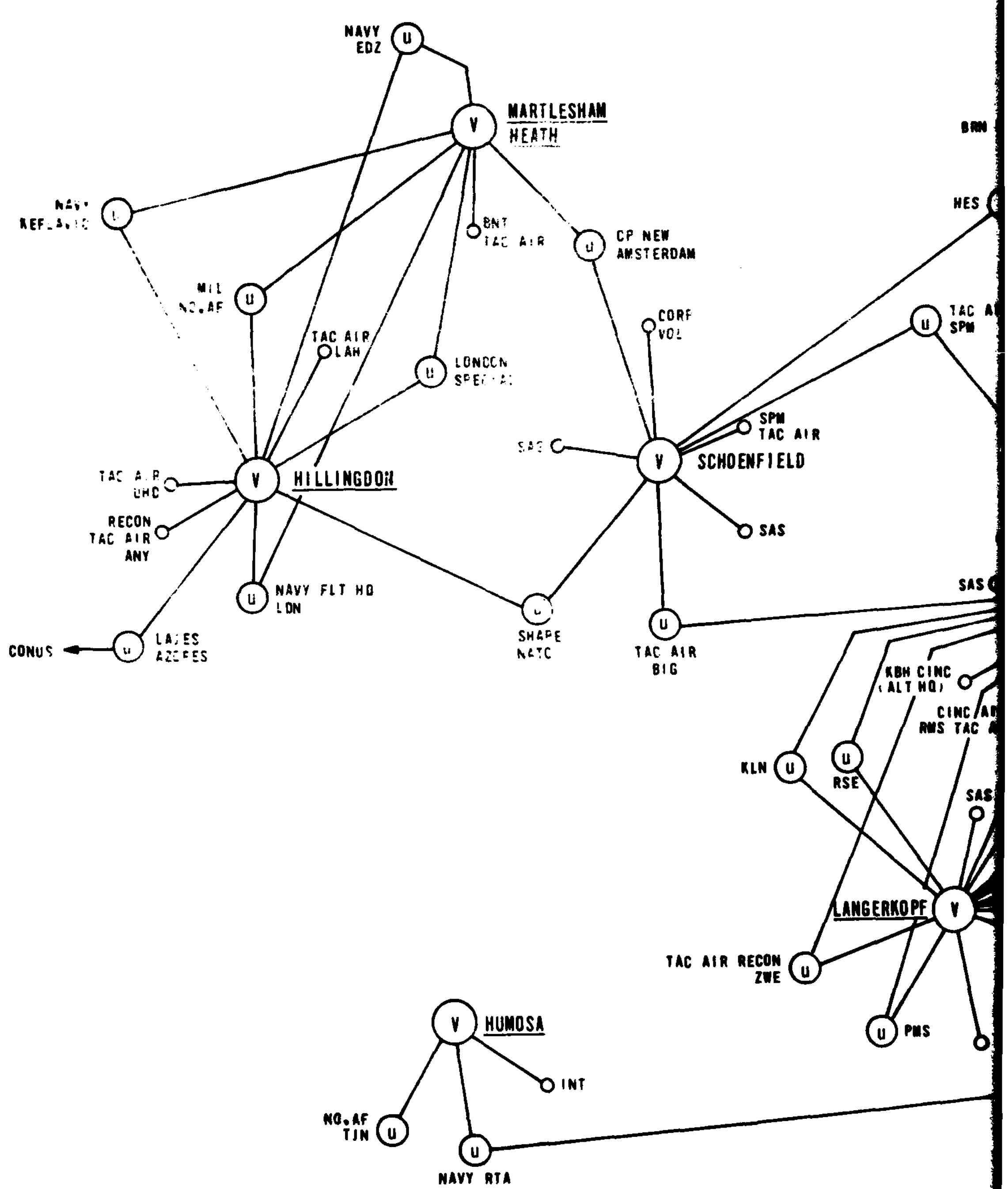
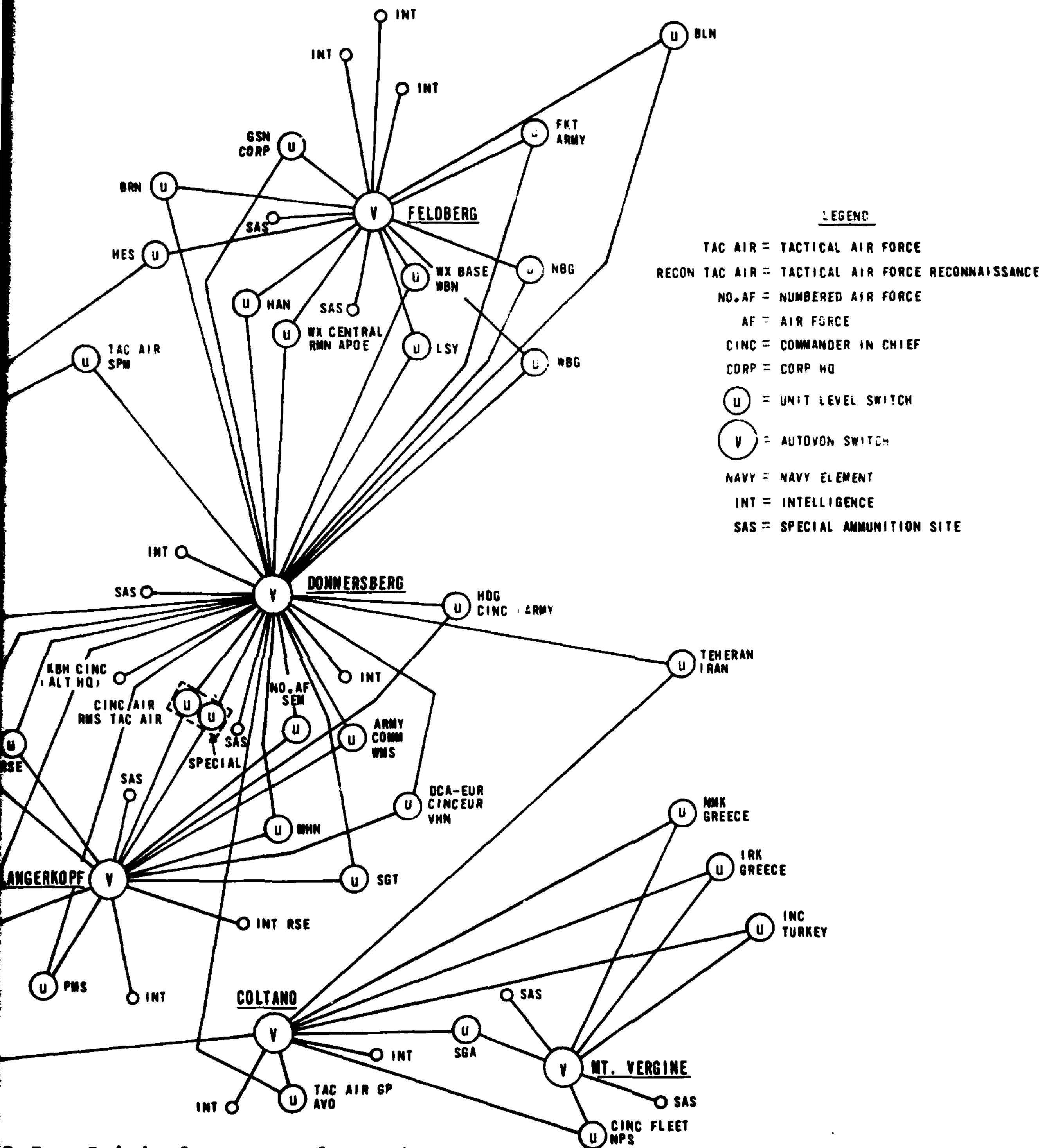


Figure 2-5. Crit



2-5. Critical User Deployment

2

(1) Allied Headquarters.

(2) Unified or Joint Headquarters and CINC's.

(3) Army Headquarters, or Fleet Headquarters.

(4) Corp or Numbered Air Force Headquarters.

(5) Tactical Force Headquarters.

(6) Intelligence Units.

(7) Special Ammunition Storage.

(8) Air Port of Entry (APOE), Weather Central or Special Purpose Facilities.

(9) All alternate headquarter facilities for categcries (1) through (3), above.

Critical users are displayed in terms of their ULS and its homing. This is not meant to imply that AUTOSEVOCOM II is the only critical user resource, but rather is a convenient way of showing the locations of critical users in the deployment model.

2.3.4 ATEC Overlay--Figure 2-6 shows the assumed ATEC deployment. Sector and Node boundries are assumed as shown with sectcr control stations at the following locations:

- Hillingdon
- Langerkopf
- Stuttgart
- Coltano

This deployment is based on the ATEC-LRIP specifications through option 3 and DCA Management Engineering plan of October 1976.

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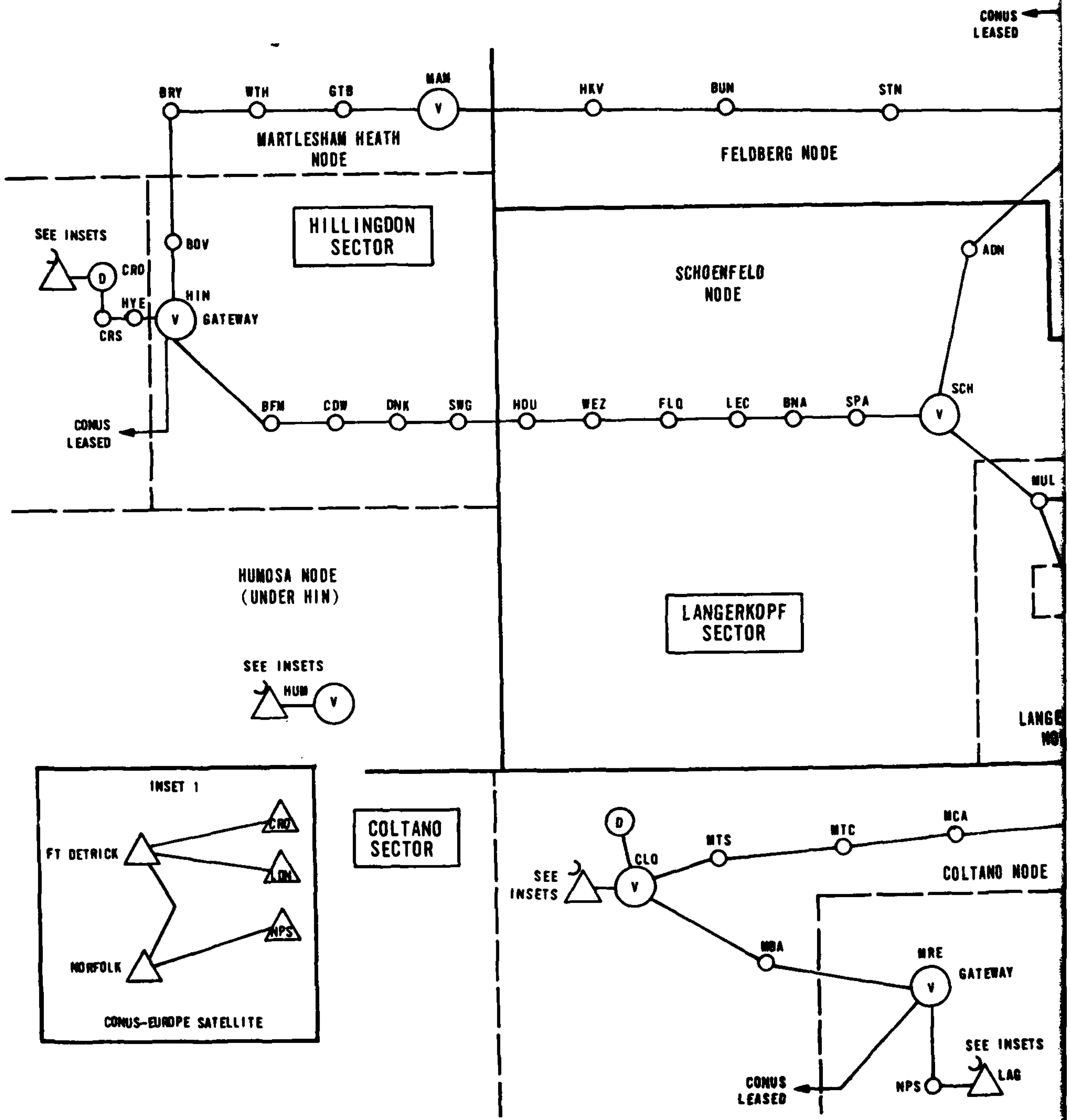
BUN = BRUGGEN, GER.
COW = COLD BLOW, U.K.
CIM = CIMA GALLINA, IT.
CLO = COLTANO, IT.
CRO = CROUGHTON, U.K.
CRS = CHRISTMAS COMMON, U.K.
DNK = DUNKIRK, U.K.
DCN = DONNERSBERG, GER.
FEL = FELDBERG, GER.

FLQ = FLOBECQ, BEL.
FZM = FRIOLZHEIM, GER.
GTB = GREAT BROMLEY, U.K.
HDG = HEIDELBERG, GER.
HDM = HEIDENHIEM, GER.
HIN = HILLINGDON, U.K.
HKV = HOEK VAN HOLLAND
HOU = HOUTEM, BEL.
HST = HOHENSTADT, GER.
HUM = HUMOSA, SP.



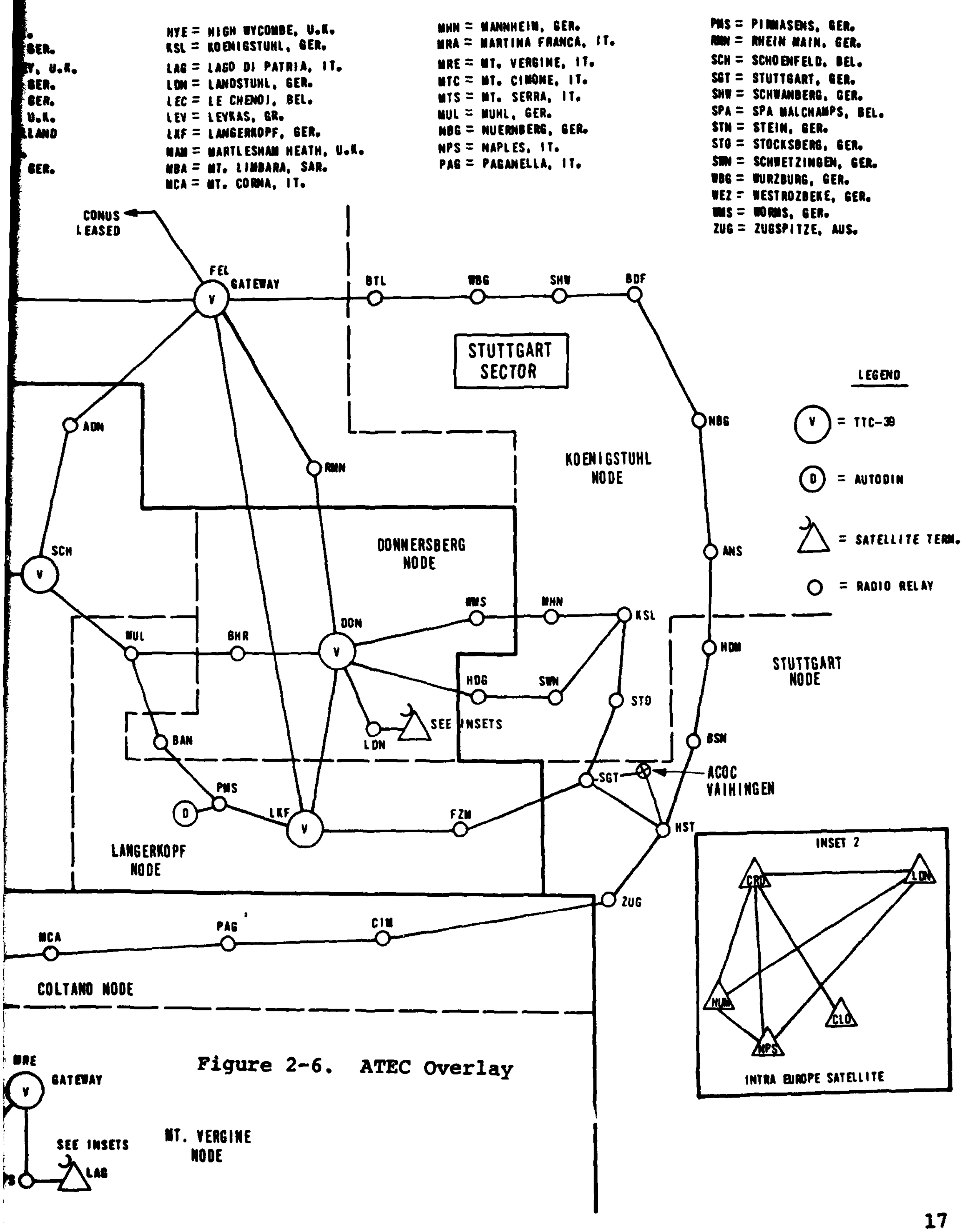
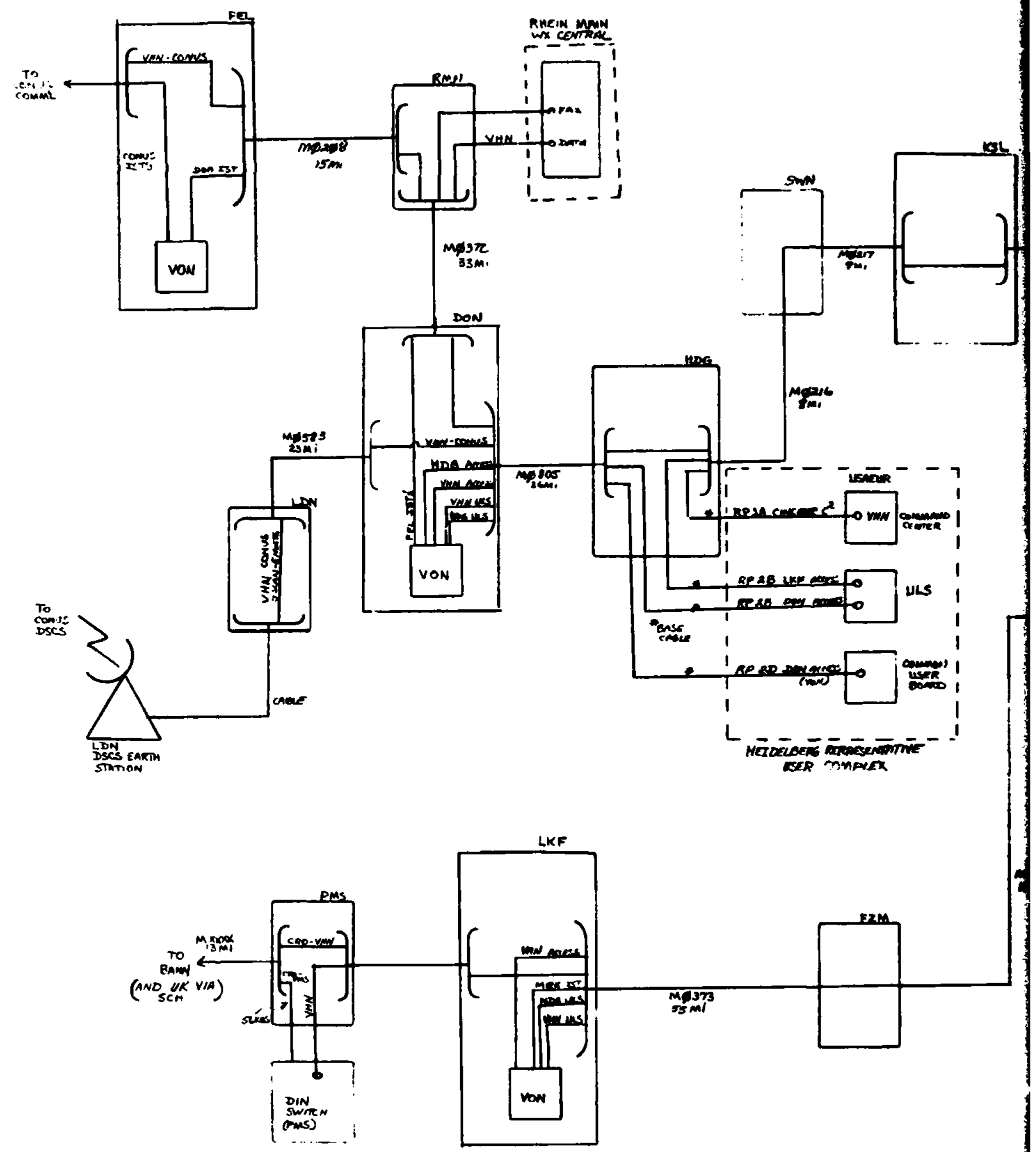


Figure 2-6. ATEC Overlay

2.3.5 System Segment Detail--Figure 2-7 shows a more detailed view of a typical segment of the model. The Vaihingen user complex is shown as a typical critical user complex containing a CINC. A representative set of circuits serving Vaihingen is shown in Table 2-II. These circuits enter the DCS at the Vaihingen station and a carried direct to Stuttgart (SGT). At SGT, some of the circuits go to FZM, while others go to STO. In both cases, the VHN circuits share the link with other user circuits and with trunk circuits. The VHN circuits which went to STO travel all the way to Donnersberg (DON) before being split again. At KSL and HDG, other circuits again joint the mission bit stream. The circuits sharing the HDG-DON link are shown in Table 2-III. This is not a comprehensive list of the circuits (the link has over 300 channels) but is a representative sample demonstrating the various types of circuits on a typical link. At Donnersberg, some of the circuits terminate (the VON and SEVOCOM access circuits for example). Others go to the LDN sattelite terminal for connection to CONUS via DSCS. Still other circuits go to Rheinmain. At Rheinmain, the weather circuits terminate at the Rheinmain weather central. The remaining circuits travel to Feldberg where they gain access to the trans-atlantic cable for an alternate media connection with CONUS.



FEL
VON
RHEIN MAIN
WX CENTRAL
RMN
VHN
MØ288
15MI
MØ372
33MI
DON
VON
MØ585
25MI
LDN
LDN
DSCS EARTH
STATION
CABLE
HDG
MØ216
8MI
MØ217
9MI
KSL
USAEUR
VHN
ULS
HEIDELBERG REPRESENTATIVE
USER COMPLEX
PMS
TO
BANN
(AND UK VIA)
SCH
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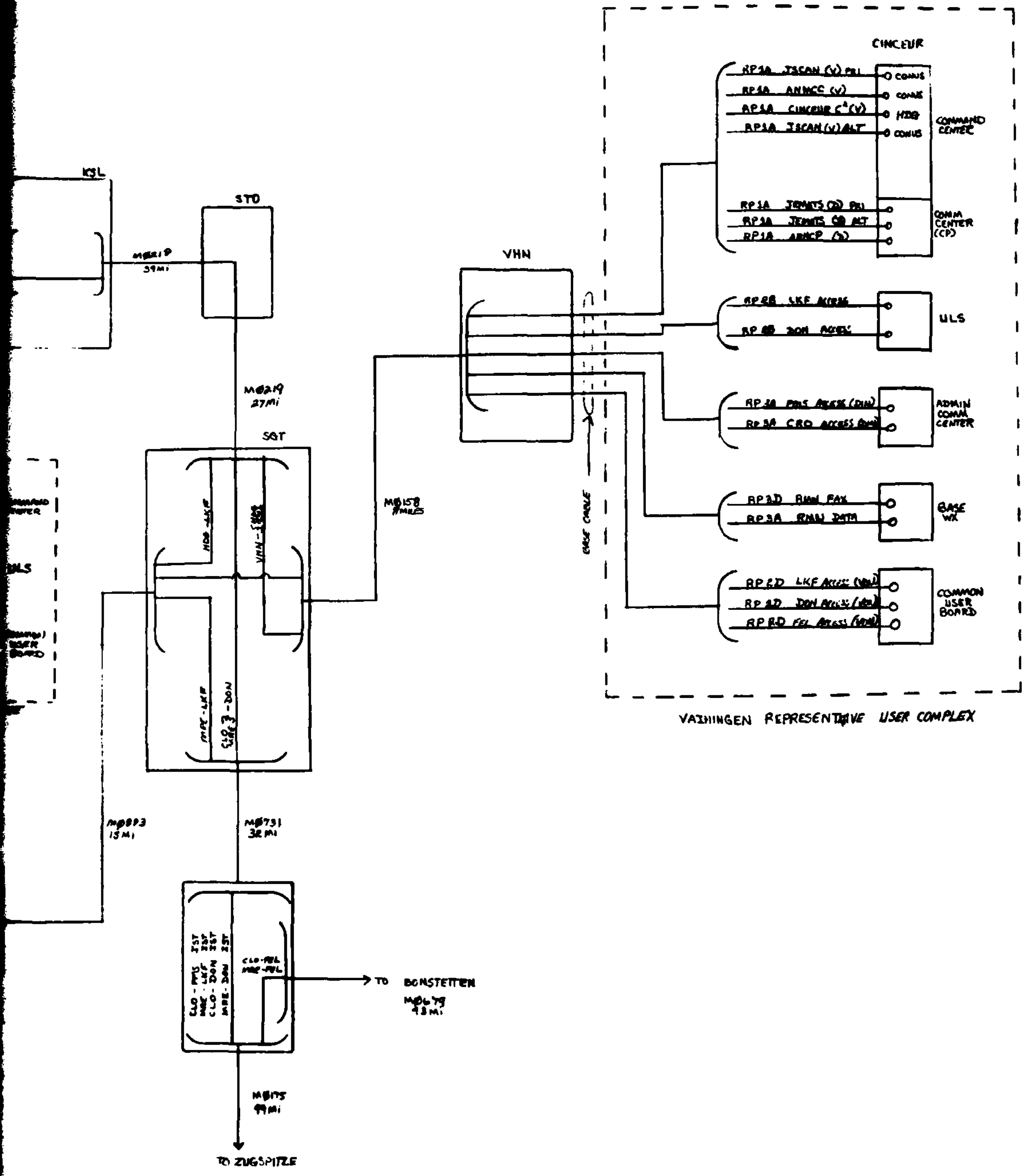
SWITCH
(PMS)
LKF
VON
MØ373
55MI
FZM

Figure 2-7. Mo(



7. **Model Segment Detail**

TABLE 2-II VAIHINGEN USER CIRCUITS

Dedicated Networks:

RP-1A	JSCAN	Voice Primary	VHN	CONUS (JCS)
	JSCAN	Voice Alternate	VHN	CONUS (JCS)
	ANMCC	Voice	VHN	CONUS (ANMCC)
	CINCEUR	Voice	VHN	HDG (USAEUR)
	JEMATS	Data (300 Baud) Pri	VHN	CONUS (JCS)
	JEMATS	Data (300 Baud) Alt	VHN	CONUS (JCS)
	ABNCP	Voice Primary	VHN	ABNCP
	ABNCP	Data (300 Baud)	VHN	ABNCP
	CINCEUR	Voice (Pri)	VHN	EMS (USAFE)
	CINCEUR	Voice (Pri)	VHN	MPS (AFSO)
	CINCEUR	Voice (Pri)	VHN	SHP (NATO)
	CINCEUR	Voice (Pri)	VHN	LIN (Navy London)
RP-2A	CINCEUR	Voice		
RP-3A	WXNET	Data (300 Baud)	VHN	RHM (2d Wx Wg)
RP-3D	WXFAX	FAX	VHN	RHW (2d Wx Wg)

Common User Networks

RP-2B	SEVOCOM	ULS Access	VHM	DOM
	SEVOCOM	ULS Access	VHN	LKP
RP-2D	VON	VON Access	VHN	LKF
	VON	VON Access	VHN	DON
	VON	VON Access	VHN	FEL
RP-3A	DIN	DIN Access (1200 Baud)	VHN	CRO (Admin)
	DIN	DIN Access (1200 Baud)	VHN	PMS (Admin)
RP-4A	VON	User Access Voice	VHN	LKF (Routine)
	VON	User Access Voice	VHN	DON (Routine)

TABLE 2-III

LINK LOADING: LINK M0305 HEIDELBERG - DONNERSBERG

DEDICATED CIRCUITRY:

RP-1 -	VOICE -	8
	DATA -	4
RP-2 -	VOICE -	11
	DATA -	3
	ULS -	21
RP-3 -	FAX -	1
	DATA -	15

COMMON USER CIRCUITRY:

RP-2 -	VOICE (VON) -	28
	DATA -	12
RP-3 -	VOICE (VON) -	33
	DATA -	18
RP-4 -	VOICE (VON) -	39
	VOICE (DDD) -	27
	DATA -	7

SPARES: 61 Channels

SECTION III. STRESS SCENARIOS

3.1 Purpose of Stress Scenarios

The purpose of the stress scenarios is to create situations which expose the requirements for system control, against which the system control system can be designed and its performance tested. Because of the complex nature of the DCS with its multiple interacting subsystems and global extent, a control subsystem cannot be designed by simply listing each and every contingency and designing a system to handle each. The number of possible situations is simply too large to be managable. The stress scenarios are a limited set of hypothetical stress situations which span the types of situations which would exist, forming a complete but very skeletal representation of the possible stress situations. The resulting scenarios are specific represenative examples of the types of stress which the system control subsystem must respond to.

3.2 Stress Scenario Creation Methodology

The stress scenarios were created by a logical decomposition of the types of stress which can exist in the deployment model, broken down by subsystem and by the functional nature of the stress. The resulting scenario selection matrix is shown in Figure 3-1. From this matrix, scenarios were developed which demonstrated different types of system stress, with as little overlap in the nature of the stress as possible. The resulting set of scenarios tends to be weighted toward the upper left hand corner of the matrix. There are several factors leading to this uneven distribution of stress scenarios across the matrix as follows:

- There are more possible stress types due to transmission system failures than either node equipment or traffic characteristics

SYSTEM STRESS	TRANSMISSION	NON-TRANSMISSION NODE EQUIPMENT	TRAFFIC
AUTOVON/AUTOSEVOCOM	SINGLE TRUNK GROUP FAILURE PARTIAL TRUNK GROUP FAILURE MULTIPLE TRUNK GROUP ACCESS CIRCUIT FAILURE	TOTAL SWITCH FAILURE SWITCH DEGRADATION	UNIFORM NETWORK WIDE OVERLOAD FOCUSED OVERLOAD
	TOTAL NODE FAILURE!		
AUTODIN II	TRUNK FAILURE MULTIPLE TRUNK FAILURE	PACKET SWITCHING NODE FAILURE	TRAFFIC EFFECTS INCLUDED IN THE NODE CTS FAILURE AND TRUNK FAILURE SCENARIOS
NON-COMMON USER	CRITICAL CIRCUIT FAILURE	SPECIAL EQUIPMENT FAILURE	NOT APPLICABLE
SYSTEM CONTROL	TELEMETRY FAILURE	SYSTEM CONTROL NODE FAILURE	CONTROL RESPONSE TIME TASK ADDRESSES TRAFFIC IN THE SYSTEM CONTROL TELEMETRY NET

Figure 3-1. Scenario Selection Matrix

- Common user networks use the transmission system in more different ways than non common user systems

- The impact of stress on a common user network is more likely to have system level implications

- AUTOVON/AUTOSEVOCOM uses more system resources than AUTODIN II

- Traffic stresses are not applicable to non common user systems

- In the particular case of AUTODIN II traffic, traffic controls already exist internal to the network such that studying pure traffic stress would not be a fruitful area of research. Traffic implications will be studied in connection with transmission and node equipment stresses.

Some of the scenarios do not easily fit into the simple matrix structure, but overlap two or more categories. One scenario which had to be included is the total failure of a DCS station. This scenario overlaps the transmission and node equipment failure categories, but it is important enough that it could not be excluded. Another way in which scenarios tend to overlap category boundaries is that a simple stress does not usually exist by itself in the DCS without some collateral stress. For example, when an AUTOVON trunk group fails due to an RF problem, it is likely that some non common user C^3 network is also impacted. Thus the stress which the scenario addresses are not the most critical in terms of restoral, and the scenario ends up overlapping the categories of common user voice and non common user networks. Since the scenarios are set in our deployment model which has characteristics similar to the DCS, this overlap cannot be avoided.

3.3 Use of the Scenarios

The scenarios form the foundation for the rest of the study. Each scenario will be examined to determine the response of the subsystem parameters. The parameters of interest in most cases are alarms or alarm messages which occur when the stress is initiated. Other parameters of interest are the traffic measurements of the common user networks such as attempts to seize trunks, trunk preempts, trunk blockages, call attempts from specific switches, etc. The value of these parameters will have changes indicative of the stress.

By collecting the set of parameter changes associated with each stress scenario, the data correlations needed to isolate a particular stress to the type of stress and geographical location can be determined. One result of this examinations will be that some of the indicative parameters are redundant, and that the time required to obtain stress isolation depends on the set of parameters used to perform the detection and isolation. Traffic parameters in particular have to be smoothed over some time period in order to obtain reliable indication of a stress. Also, different traffic parameters provide the same basic information summarized in different forms. As a consequence of these characteristics, not all of the indicative parameters need be used to detect and isolate the stress. Only a subset of the parameters are needed. The parameter selection task will determine the minimum practical set of parameters required to detect the stress scenario stresses.

After the set of parameters needed for stress detection and isolation have been determined, a reference to the deployment model will show where these parameters are generated and what location in the system control hierarchy can gather the set of parameters together. This leads to the communication needlines to get the needed parameters from their generation point to the point of stress visibility.

The algorithms needed to perform the stress detection and isolation function is also determined by analysis of the indicating parameter set for each of the stress scenarios. This provides a set of processing requirements whose overall magnitude can be estimated and apportioned to modifications of existing equipment and required new equipment.

In the second phase of the study, control algorithms which relieve the system stresses will be developed. This is done by examining each stress scenario and determining control actions which respond to the scenario. The control actions which are demonstratively effective and practical can be fitted into an overall algorithm framework for the control of the entire system.

This resulting control algorithm will then be tested against the stress scenarios to determine its performance. Specific performance indicators include the following:

- Control time response
- Resulting network performance measures
- Effect of the controls on system availability to critical users
- Changes in manning requirements resulting from control application

These performance indicators will provide a quantitative measure of the benefits obtained by the imposition of system controls.

Also as a result of the developed control algorithms, the system capabilities needed to implement the control structure becomes

evident. Factors such as additional hardware/software, changes in parameters acquired during control application, and interface requirements will be determined.

3.4 Introduction to Scenario Data

The following sections present the stress scenarios. Three types of scenario information are presented as follows:

- A scenario list, describing the basic event involved in the scenario and why it is included. This list includes all 34 scenarios which have been generated.

- For two scenarios, an example scenario solution. The scenario solution includes the scenario itself, a listing of collateral stresses which would occur along with the specified stress in our deployment model, the estimated time duration of the stress, the indicating parameters and their sources, detection and isolation techniques, control responses and a time sequence of events caused by scenario.

- For 5 scenarios, the scenario details along with indicating parameters, a summary of the system impact, estimated time to repair, and possible control actions are presented.

The control actions, time sequence of events, etc., are preliminary ideas and are not based on extensive analysis. The scenario solution, which contains these items, will be developed over the course of the study. Actual scenario solutions will become part of the fourth and final report on this study. The solution examples shown are just for demonstration of the concept of scenario solution.

3.4.1 Scenario List--The following is a list of the scenarios which have been developed as the basis for system control. They are grouped by the subsystem which generated the stress scenario. Along with each scenario description is the rationale for its inclusion on the list.

AUTOVON/AUTOSEVOCOM Stresses

1. Peak traffic load condition - All system elements functional. This scenario is the nominal system situation without any stresses. It is inlcuded because its the standard against which other situations will be compared.

2. Node outage - The European gateway AUTOVON switch and the associated transmission equipment at Feldberg Germany is destroyed. This scenario is an example of a major inter area connectivity loss affecting both the network node equipment and the associated transmission links.

3. Switch Failure, node intact - The European gateway AUTOVON switch at Feldberg, Germany fails due to internal equipment failure. Emergency bypass function remains operable. The initial system impact of this scenario is the same as Scenario 2, however in this case only the network node equipment is affected. The associated transmission links are intact and can be used for establishing a modified connectivity utilizing the transmission resources previously used by the failed switch. Of particular interest is how this scenario is isolated from Scenario 2.

4. Switch degradation - The Feldberg Germany AUTOVON switch experiences a partial digit receiver outage. This scenario is an example of a hardware failure in the switch equipment which degrades performance, but in which the switch is still processing calls.

5. Node outage - The AUTOVON switch and associated transmission equipment at Donnersberg Germany is destroyed. This scenario is similar to scenario 2 except that Donnersberg is the major intra European tandem switch rather than a major inter area switch. The effect on the network could be considerably different.

6. Switch failure, node intact - The AUTOVON switch at Donnersberg Germany fails. This scenario is the same as Scenario 5 in initial system impact, but since the transmission system is still operable the restoral possibilities are different.

7. Switch degradation - The Donnersberg AUTOVON switch experiences a partial digit receiver failure. This is an example of a common equipment failure which degrades switch performance, but allows the switch to continue processing calls at reduced capacity.

8. Node isolation - the Feldberg Germany switch node is completely isolated by transmission system failure. This scenario is related to scenarios 2 and 3 in that the initial system impact is the same. It is included so that isolation techniques can be developed to separate this case from scenarios 2 and 3. The restoral possibilities are different.

9. Switch route failure - All interswitch trunks between the AUTOVON switches at Donnersberg and Feldberg are interrupted due to transmission system failure. This network link is the most heavily loaded link in Europe, both in terms of traffic handled and number of routes (source destination pairs) traversing it. This scenario provides a worst case sitation resulting from a single network link failure.

10. Reduction in IST's - Fifty percent of the interswitch trunks between Feldberg and Donnersberg AUTOVON switches fail due to transmission system failure. This scenario is similar to scenario 9 except that instead of a connectivity loss, there is a reduction in the connectivity capacity. Of paricular interest are the differences in network effect and indicating parameters between this scenario and scenario 9.

11. Muliple switch route failure - All IST's between the Donnersberg, Germany switch and the switches at Langerkopf Germany and Coltano and Mt. Vergine Italy fail due to transmission system failure. This scenario demonstrates the effect on the network when a large portion of the intra Europe connectivity in one area is disrupted without isolation of any of the switches

12. Multiple time phased switch failures - the gateway AUTOVON switch at Hillingdon England fails, followed by the failure of the gateway AUTOVON switch at Feldberg Germany 30 minutes later. In addition to creating a more serious network failure than scenario 3, this scenario is inlcuded to show the interaction between applying controls and further failures. This provides a good test of the stability of the control algorithms.

13. Multiple time phased switch failures - the gateway AUTOVON switch at Hillingdon England fails, followed by the failure of the gateway AUTOVON switch at Feldberg Germany 30 minutes later. In addition to creating a more serious network failure than scenario 3, this scenario is included to show the interact between applying controls and further failures. This provides a good test of the stability of the control algorithms.

14. ULS Failure - The Heidelberg Germany unit level switch (ULS) fails. This scenario is an example of a system failure affecting only a small group of users. It will demonstrate how system control can respond to a failure in critical subscriber access equipment.

15. Loss of ULS access circuits - the access route from the Frankfurt ULS to the Donnersberg AUTOVON/AUTOSEVOCOM switch is interrupted by transmission system failure. This scenario is included to determine the criticality of restoring access circuits, and to determine how system control can observe access area stress.

16. General AUTOVON overload - with all network elements operating properly, traffic increases uniformly the network to 250% of the design traffic. This scenario tests the capability of the common user voice network to operate in an overload situation, and to determine how to detect traffic stress.

17. Focussed AUTOVON overload - originating traffic at the Donnersberg switch increases to 600% of design capacity.

The rest of the network is at normal design busy hour. This scenario is included to show how traffic stress at a single point in the netwrok spreads to the rest of the network, and how this situation can be detected and controlled.

Combinations of AUTOVON Stresses

The next five scenarios are combinations of the preceding scenarios. These combinations are included in order to study the interactions between stress types, and to insure that any control algorithms developed don't aggravate a multiple failure situation.

18. Traffic overload and switch failure - during the 600% overload of the Donnersberg switch, the gateway switch at Feldberg fails.

19. Traffic overload and multiple swtich failure - during the 600% overload of Donnersberg with the Feldberg switch out of service the Hillingdon gateway switch also fails.

20. Switch and transmission failure - the AUTOVON switch at Schoenfeld Germany fails while the Donnersberg switch is operating in a degraded mode and the DEB fails between Zugspitze Germany and Hohenstadt Germany.

21. Inter area transmission failures - the inter area DSCS links and the TAT1 and TAT2 cables fail.

22. Traffic overload with switch and transmission failures - The Hillingdon switch, the transmission system between Mt. Corna and Coltano, and the European DSCS all fail while the network is carrying 250% of design traffic.

Non Common User Network Stresses

23. CINCUSAFE Voice Alerting Network equipment failure. The purpose of this scenario is to determine how system control can guarantee critical subscriber connectivity in spite of equipment failures.

24. Transmission failure isolating airborne command post from ground command authority. This scenario demonstrates the responsiveness of system control to a high precedence network failure in a temporary network hookup.

25. Multiple critical non common user network outages. The Hillingdon England to Schoenfeld Germany DEB fails at Houtem Belgium interrupting CINCUSAFE, CINCEUR, and Navy command and control networks along with other critical networks. This scenario addresses the problem of what happens when multiple critical networks simultaneously require restoral.

System Control Stresses

The following five scenarios deal with stresses within the system control subsystem. These stresses should not affect the operation of any other subsystem since the DCS should continue to operate regardless of any faults in system control. These scenarios demonstrate how the system control function is independent of DCS operation.

26. DCAOC isolated from ACOC - the ACOC at Vaihingen Germany is isolated from world Hq. by the loss of on base cable. This scenario demonstrates that the area system control functions can be accomplished independently from world Hq.

27. ACOC destroyed - The European ACOC at Vaihingen Germany is destroyed. This scenario demonstrates the ability of the system to operate with a major control point destroyed.

28. Node isolated - Donnersberg nodal control station is isolated from the sector control it reports to (Langerkopf) by a failure in telemetry equipment. This scenario is included to examine the properties of the system control system when a prime information transfer path is interrupted.

29. Sector/Area isolation with switch failure - while Langerkopf is isolated from area due to a telemetry failure, the AUTOVON switch at Donnersberg (which is in Langerkopf sector) fails. The purpose of this scenario is to test the sensitivity of the control system to losses in communications capability.

30. Multiple Sector Failures - Sectors at Langerkopf and Coltano fail sequentially for unrelated reasons. This scenario demonstrates the effect of returning to manual procedures for a temporary time period.

AUTODIN Stresses

The following scenarios deal with AUTODIN II stresses. This network is very self controlling in that it has its own network control center which performs some control functions, and that it was designed using a self-adaptive routing strategy and traffic control protocols to prevent lockups. The only type of system control left to be accomplished is the addition/restoral of connectivity. The scenarios included in this list emphasize this aspect of system control.

31. The Pirmasens, Germany AUTODIN II packet switching node (PSN) is completely destroyed during peak traffic. This scenario was included to study the effect of a major equipment failure in DIN II.

32. The 56 KB/sec trunk between the PSN's at Pirmasens Germany and Croughton England is disrupted by transmission system failure. The purpose of this scenario is to study how to detect and restore AUTODIN transmission faults.

33. The 56Kb/sec trunk between the Andrews PSN and Croughton PSN is disrupted due to a failure of leased facilities. The purpose of this scenario is to demonstrate the difference between intra Europe failures and inter area failures.

34. All intra Europe AUTODIN trunks are disrupted by unrelated transmission system faults. This scenario is included to show the effects of major transmission system stress.

3.4.2 Scenario Solution Examples--Scenario 9 - Route failure

I. Synopsis - The RF link between Donnersberg and Rhein Main Germany fails due to antenna malfunction. This link was chosen for this scenario since, in our deployment model, it interrupts the most heavily loaded intra European AUTOVON/AUTOSEVOCOM trunk group. Therefore the DCS experiences the highest stress level of any single AUTOVON/AUTOSEVOCOM trunk group. The specific failure mode is an example of the type of failure that could cause this stress. Many other failure modes exist which would lead to the same scenario.

II. Colateral Stress - According to our deployment model, the following system stresses also exist if that link fails:

- Command and control non common user voice circuits between Ramstein and Berlin, and Ramstein and Rheinmain are interrupted

- Rheinmain AUTOVON users access circuits are interrupted

- The access circuits from Frankfurt ULS to Donnersberg are interrupted. Frankfurt still has network access via Feldberg

- The weather FAX network is interrupted except for Feldberg homed users

III. Estimated Time Duration of Stress - needed because in come cases, the stress duration may be shorter than the control response time, in which case controls are ineffective. For this scenario, the estiamted time to repair is 6 hours, based on emergency dispatch from the Antenna Maintenance Group at Rheinmain arriving on the scene approximately 1 hour after stress occurrence, and 5 hour repair time.

IV. Stress Indicating Parameters

A. TTC-39 System Control Reports--The TTC-39 switches at Donnersberg and Feldberg would issue several reports via their system control subchannel as specified in ICD-004, relating to the failure of the trunk group. Upon the occurrence of the stress, the following reports would be issued:

R30 - Failure of trunk group cluster
R31 - Loss of trunk group synchronization
R52 - Trunk group FIFO overflow

Real time parameter reports, issued within 10 minutes of stress occurrence, which indicated the nature of the stress, include the following

R5 - Calls incoming on trunk group parameter
Call attempts drops to zero
Call attemps on alternate routes increases

R27 - Error rate on framing channel reports out out of sync

If statistical reports are set to be transmitted frequently, the R41 report from the Rheinmain ULS would show no switch accesses from Rheinmain. Also, the next time the Donnersberg switch performed its loop continuity test to the Rheinmain ULS, a local alarm would be generated at the Donnersberg switch.

B. ATEC Indicators

1. Loss of received signal level sensed at Rheinmain and Donnersberg by the ATEC ARS element

2. Loss of multiplex framing sensed at Rheinmain and Donnersberg by the ATEC ARS element

V. Stress Detection and Isolation

Correlation of the trunk group failure messages from Donnersberg and Feldberg indicates a failure in that transmission path. ATEC alarm data confirms the transmission failure and isolates the exact location.

VI. Control Response

By referencing the data base at node and sector level, system control can determine that the C^2 and weather FAX circuits are also disrupted, and can direct preemption and patching at Donnersberg, Feldberg and Langerkopf to restore those circuits. In order to meet performance objectives, additional routes from Donnersberg to Feldberg via Schoenfeld and via Martlesham Heath should be activated in the Feldberg and Donnersberg load without requiring intercontinental coordination.

VII. Scenario Time Sequence

t_o - RF link from Donnersberg to Rheinmain fails

t_o + 1 sec - Switches at Donnersberg and Feldberg issue trunk group failure reports

t_o + 2 sec - ATEC alarm reports of loss of RSL and multiplex framing alarm at Rheinmain and Donnersberg arrive at Feldberg and Donnersberg nodes respectively

t_o + 10 sec - Switch reports arrive at area

t_o + 15 sec - Area requests transmission status from Langerkopf sector

t_o + 30 sec - Langerkopf reports failure of Donnersberg-Rheinmain link to area. Data base access at Donnersberg node reveals the C^2 and weather FAX collateral stress, and requests Langerkopf sector to check on the availability of links in the preplanned altroute

t_o + 40 sec - Area determines routing table changes for Donnersberg, Feldberg, Schoenfeld, and Martlesham Heath switches, and issues system control messages to those switches via telemetry

t_o + 60 sec - Donnersberg receives status of preplanned altroute, initiates patching. Donnersberg also sends patch coordination to Langerkopf.

t_o + 65 sec - Donnersberg sends patch instruction to Feldberg node via Stuttgart sector

t_o + 70 sec - Donnersberg switch executes loop test to Rheinmain ULS, activating a local alarm at Donnersberg. Since restoral activity has already been completed, alarm is ignored.

t_o + 400 sec - Real time traffic reports from Donnersberg and Feldberg indicating stress arrive at area. Since control action is already completed, no further action is taken

t_o + 600 sec - Patching of C^2 and weather FAX is completed

t_1 (t_o + 6 hours) - Link restored

T_1 + 1 sec - Donnersberg and Feldberg report restoral of trunk group to area

T_1 + 2 sec - Donnersberg notifies Langerkopf to return to normal configuration. Langerkopf notifies Feldberg via Stuttgart.

T_1 + 10 sec - Area broadcasts message to Donnersberg, Feldberg, Schoenfeld, and Martlesham Heath to return to normal routing tables.

Scenario 6 - Switch Failure

I. Synopsis - The TTC-39 at Donnersberg Germany fails due to a switch control group failure in combination with a CPU failure such that no switchover occurs. The station is intact, as is the essential user bypass function of the switch. Donnersberg was picked for this scenario because it is a tandem switch for more routes than any other switch - 31 primary, 34 secondary, and 7 tertiary, in addition to having a heavy originating load. Failure of Donnersberg creates more intra European system stress than any other single node failure.

II. Collateral Stress - Since this failure is a subsystem equipment failure, no other subsystem are affected

III. Estimated Time Duration - One hour. Local maintenance personnel can repair the fault by replacing a single printed circuit card.

IV. Stress Indicating Parameters

A. TTC-39 system control reports CLO,HIN,FEL,HUM,LKF,SCH,MAM, and MRE will all issue reports related to the failure of DON. On occurrence of the fault, the R30 report - Failure of trunk group cluster will be issued. Real time traffic parameter reports also indicate the nature of the stress, including the following reports:

R5 - Calls incoming from Donnersberg drops to zero at all adjacent switches
Average number of trunks busy drops to zero
Attempts on trunks to Donnersberg drops to zero

R27 - Error rate on framing channel indicates out of sync

At the system control point which Donnersberg reports to, the lack of real time traffic parameter reports indicates a problem with either the Donnersberg switch or the system control telemetry.

Locally, the CPU failure would result in a major alarm at the switch supervisor position

V. Stress Detection and Isolation

Correlation of trunk failure reports from all switches connected to Donnersberg, along with the failure of Donnersberg to provide its real time report and the lack of any transmission alarms indicates a switch equipment malfunction. This must be done at the area level, since only at that level does the visibility exist to correlate the messages form all the connecting switches. Note that the reports issued are very similar to the previous scenario, although the cause is much different. It is the correlation of the reports from various monitoring points that allows stress isolation.

VI. Control Response

All ULS's homed on Donnersberg are dual homed, so no control response is necessary for a one hour outage. Directly homed critical users (40) and high priority users (90) can be rehomed to Langerkopf, Schoenfeld, and Feldberg using transmission assets previously used for trunking. Trunks traversing the stations at Langerkopf, Schoefeld, and Feldberg can be terminated at those switches

to increase the connectivity of the remaining network. In order to see that the transmission assets can be configured in this manner, total network visibility is needed.

Contingency routing tables must be activated in all European switches to adjust to the new connectivity.

VII. Scenario Tim Sequence

t_o - Donnersberg switch fails. Local alarm is sounded.

t_o + 1 sec - Coltano, Hillingdon, Feldberg, Humosa, Langerkopf, Schoenfeld, Martlesham Heath and Mt. Vergine all issue trunk failure reports relative to the trunk to Donnersberg. These reports enter the system control telemetry system and flow to area.

t_o + 10 sec - Failure reports arrive at area. Area correlates the reports and determines that a Donnersberg node problem exists.

t_o + 15 sec - Area request transmission system status from all ATEC sectors.

t_o + 30 sec - ATEC sectors respond to area that all transmission assets are functioning normally. Local swtich personnel at Donnersberg notice alarm, activate the critical user bypass and begin troubleshooting switch.

t_o + 40 sec - Area issues routing table modifications to all European switches to bypass Donnersberg. Area issues patching instructions to Langerkopf, Schoenfeld, and Feldberg to terminate traversing trunks on their switch matrices.

t_o + 15 min - All patching completed.

t_1 (t_o + 60 min) - Donnersberg switch returned to operational condition.

t_1 + 1 sec - Switch on line message transmitted to area.

t_1 + 30 sec - Area issues message to all switches to return to normal configuration.

t_1 + 300 sec - All patches removed, messages reporting this are forwarded to area.

t_1 + 305 sec - Area directs Donnersberg to remove the essential users bypass.

t_1 + 330 sec - Essential user bypass is removed by Donnersberg personnel.

3.4.3 Scenario Details--This section contains the details of five of the scenarios:

- Partial switch route failure
- ULS failure
- General AUTOVON network overload
- ATEC node isolation
- AUTODIN intra Europe trunk failure

Also included in this section is a preliminary sketch of the solution for these scenarios.

Scenario Ten - Partial Switch Route Failure

I. Synopsis: First level PCM/TDM multiplex failures on the Donnersberg, Rhein Main, Feldberg transmission system interrupt one-third of the Donnersberg-Feldberg AUTOVON swtich analog IST's.

II. Traffic Level: Peak traffic load -- Monday, 0800 hours.

III. Switch Equipment: All equipment if functioning.

IV. Connectivity Status:

A. At zero hour, di-group 7 of Donnersberg - Rhein Main - Feldberg B mission bit stream fails due to an equipment malfunction at Donnersberg. This generates a MUX alarm at both Feldberg and Donnersberg.

B. Feldberg maintenance, responding at zero +10 minutes, believes it may be his problem and pulls a MUX card for substitution. In doing so, he selects di-group 6 of B mission bit stream by mistake, thus removing this di-group from service. In replacing the card, he uses the wrong card so the di-group remains out.

C. The end result is that 18 of the 30 analog Donnersberg - Feldberg IST's and all digital IST's are removed from service.

V. Failure Indications: The following failure indicators would be present upon loss of the Donnersberg - Rhein Main - Feldberg di-groups.

A. ATEC Loss of Multiplex Framing Alarms: The initial failure, Donnersberg - Feldberg, di-group 7 of B mission bit stream would appear as a first level MUX Framing Alarm at both Donnersberg and Feldberg. The second failure involving di-group 6 of B mission bit stream would produce the same alarms. Sensing stations would be as follows:

Sensing Station	Reported to ATEC Nodal	Reported to ATEC Sector
Feldberg	Feldberg	Stuttgart
Donnersberg	Donnersberg	Langerkopf

B. Overt AUTOVON Indicators
If the signalling channel is affected, Donnersberg and Feldberg switches will issue the following reports:

a. Trunk group out of service

b. Failure of signalling on dead trunk reported

c. Trunk group loss of synchronization

d. Local TSB's may be reported out of service

e. Error rate on framing channel out of sync

f. Trunk group FIFO overflow report may occur

g. All traffic parameters on alternate routes between terminating switches show increased traffic (attempts, blocking, preemptions, occupancy).

If the signalling channel is not affected, no reports are issued.

C. Subtle AUTOVON Indicators

If the signalling channel is not affected, the following traffic parameter changes occur:

1. Blocking rate, preemption rate, and average occupancy of trunk group decrease due to decreased holding time

2. Calls offered to alternate routes decreases

If the signalling channel is affected, the following traffic parameter changes occur:

1. Blocking rate and preemption rate of affected group increases

2. Blocking due to common equipment increases due to the use of inband signalling

3. All traffic parameters on alternate routes shows increased traffic

VI. System Impact

TABLE 3-I. NETWORK IMPACT OF TRUNK 16 FAILURE

12 PRIMARY,27 SECONDARY AND,12 TERTIARY ROUTES

PRIMARY ROUTES	SECONDARY ROUTES	TERTIARY ROUTES
CON(1)-SCH(4)	CON(1)-MAM(3)	CON(1)-FEL(5)
CON(1)-DON(6)	CON(1)-DON(6)	CON(1)-DON(6)
CON(1)-LKF(7)	CON(1)-CLO(8)	CON(1)-HUM(11)
SCH(4)-MAM(3)	CON(1)-MRE(9)	HIN(2)-DON(6)
SCH(4)-CLO(8)	CON(1)-PAT(10)	SCH(4)-DON(6)
SCH(4)-MRE(9)	MAM(3)-FEL(5)	DON(6)-HIN(2)
SCH(4)-HUM(11)	MAM(3)-DON(6)	DON(6)-MAM(3)
FEL(5)-DON(6)	SCH(4)-CON(1)	DON(6)-SCH(4)
DON(6)-CON(1)	SCH(4)-FEL(5)	DON(6)-MRE(9)
DON(6)-FEL(5)	SCH(4)-LKF(7)	DON(6)-HUM(11)
PAT(10)-FEL(5)	FEL(5)-MAM(3)	LKF(7)-DON(6)
HUM(11)-FEL(5)	FEL(5)-SCH(4)	MRE(9)-DON(6)
	FEL(5)-LKF(7)	
	FEL(5)-CLO(8)	
	FEL(5)-MRE(9)	
	FEL(5)-PAT(10)	
	FEL(5)-HUM(11)	
	DON(6)-LKF(7)	
	DON(6)-CLO(8)	
	LKF(7)-FEL(5)	
	CLO(8)-FEL(5)	
	CLO(8)-DON(6)	
	MRE(9)-FEL(5)	
	PAT(10)-FEL(5)	
	PAT(10)-DON(6)	
	HUM(11)-FEL(5)	
	HUM(11)-DON(6)	

A. DCS Connectivity: The multiplex failures result in the loss of two di-groups (48 channels) between Donnersberg and Feldberg.

B. AUTOVON/AUTOSEVOCOM: 18 analog and 10 digital IST's between the Donnersberg and Feldberg AUTOVON switches are impacted. The routes affected by the degradations are shown in Table 3-I.

C. Command and Control: No impacted.

D. Special Networks: 1-1/2 hours.

VII. Estimated Time to Repair: 1-1/2 hours.

A. Di-group 6 B mission bit stream -- 30 minutes for detection, fault isolation, and restoral.

B. Di-group 7 B mission bit stream -- 1 hour for detection, fault isolation, and repair. This is due to confusion created by personnel error in distant end maintenance.

VIII. Temporary Restoration Possibilities Control Actions

A. Station: See VII., above.

B. System: None.

C. AUTOVON/AUTOSEVOCOM: Reconfigure link laoding so that signalling channel is connected. Change trunk group size in Donnersberg and Feldberg switches such that affected digroups are not used.

D. Special Networks: None required

Scenario Fourteen - Unit Level Switch (Concentrator Failure)

I. Synopsis: This scenario addresses the failure of the Unit Level Switch (ULS) at Heidelberg, Germany. This ULS acts as a concentrator, and fails internally during the peak traffic period.

II. Traffic Level: Peak traffic load -- Monday, 0800 hours.

III. Switch Equipment: All European AUTOVON switches are functioning normally. The Heidelberg ULS has failed internally.

IV. Connectivity Status: All DCS links and VF circuits functioning normally.

V. Failure Indicators:

A. AUTOVON Switch: The Heidelberg ULS is homed off of the Donnersberg and Langerkopf switches. Loss of the ULS would create alarms at both locations upon the next execution of switch tech control routines. Both switches generate loss of trunk failure messages to their parent ATEC Sector (Langerkopf) upon loss of the ULS.

B. ULS: Alarm will occur at the Heidelberg ULS indicating switch failure. This alarm is detected by the ULS operator and is transmitted via voice order wire to the Koenigstuhl ATEC nodal.

VI. <u>System Impact</u>: Fifty (50) users of the Heidelberg ULS are impacted. The breakdown is as follows:

Heidelberg	45 Users
Schwetzingen	2 Users
Seckenheim	3 Users

VII. <u>Estimated Time to Repair</u>: 1.5 hours to fault isolate and restore the Heidelberg ULS.

VIII. <u>Control Actions and Temporary Restoral Possibilities:</u> To be determined. None appear possible.

Scenario Sixteen - General AUTOVON Network Overload

I. Synopsis: This scenario addresses the general overload of the entire European AUTOVON network, brought about by military operations.

II. Traffic Level: 250 percent above peak traffic load for the entire European AUTOVON network.

III. Switch Equipment: All switches fully operational.

IV. Connectivity Status: All DCS links and VF circuits functioning normally.

V. Failure Indicators: There is no failure. Primary indicators are the call arrival rates as reported by the switches. Secondary indicators are blocked calls, preemption rates, trunk group occupancy, etc.

VI. System Impact: AUTOVON overloading is not a system failure. Service may be degraded below performance standards. In severe overload (probably much greater than 250%) network throughput decreases with increasing offered traffic.

VII. Estimated Time to Repair: There is not equipment failure. This section provides a brief chronological scenario of the traffic build and reduction.

Chronological Scenario:

0800 Hours	Network is at peak traffic level.
0830 Hours	Military operations commence with command and control notifications. Network now experiencing peak traffic plus 15 percent.
0845 Hours	Full administrative and command control operations have now driven the network to peak traffic plus 150 percent.
0900 Hours	Pyramiding communications requirements subsequent to the command and control activities have now driven the system to peak traffic plus 250 percent.
0930 Hours	Communications requirements have normalized and increased military operations reach their level of execution. Network loading has now dropped to peak loading plus 75 percent.

VIII. <u>Control Actions and Temporary Restoral Possibilities:</u>
It is reiterated that we are not dealing with a system or network outage, but a heavy traffic overload placed on the network by increased military operations. Therefore, control and restoral actions are limited to those activities which can reduce the network burden, or provide greater traffic throughput. Only those actions are addressed on the following page.

A. Activation of additional IST's: Additional connectivity may be available on a short time basis.

B. Inhibit Route by Precedence: In severe overload condition restricting routine traffic to primary routing only will provide more network throughput.

C. Line Load Control: In critical overload, routine subscribers will be denied network access to reduce the traffic load.

Scenario Twenty-Eight - ATEC Node Isolation

I. Synopsis: This scenario addresses the isolation of the Donnersberg ATEC node from the Langerkopf sector due to failure in the telemetry equipment at Langerkopf. The purpose of this scenario is to evaluate SYSCON techniques and procedures under stress.

II. Traffic Level: Not Applicable

III. Switch Equipment: Not Applicable

IV. Connectivity Status: All links and circuits are functioning normally.

V. Failure Indications: Loss of telemetry between Donnersberg and Langerkopf causes ATEC alarms and controller messages to be generated at both locations.

VI. System Impact: The Donnersberg node is isolated from the Langerkopf sector. Data base updates and instructions normally received from the sector are interrupted and are stored at the sector fending restoral of telemetry. Measurement and status information nomally sent to the sector are stored at the Donnersberg node until telemetry is restored. The Donnersberg nodal can only request testing and measurement actions within its own nodal.

VII. Estimated Time to Repair: 1.0 hour to dispatch maintenance fault isolate and repair.

VIII. <u>Control Actions and Temporary Restoral Possibilities:</u>
No control actions or temporary restoral possibilities exist. Restoral can be affected only through repair of telemetry equipment.

Scenario Thirty-Two - Disruption of 56 KB/S Intra-Europe Interswitch Trunk

I. Synopsis: This scenario addresses the disruption of the Croughton, England, to Pirmasens, Germany, 56 KB/S AUTODIN IST due to a partial transmission system failure at Schoenfeld Radio Relay. The purpose of this scenario is to evaluate control and restoral actions, and SYSCON hierarchical level of execution.

II. Traffic Level: Peak traffic load - Friday 1700 hours.

III. Switch Equipment: All switch equipment and European PSN are functioning normally.

IV. Connectivity Status: Interconnecting cabling between di-group 1 of link M0067 (Muhl-Schoenfeld) and di-group 2 of link M0908 (Schoenfeld-Spa Malchamps and Hillingdon), is inadvertently cut by maintenance personnel, interrupting all traffic exchange. The loss of this interconnect disrupts the Pirmasens-Croughton IST.

FAILURE INDICATION:

A. ATEC: Due to the nature of the failure at Schoenfeld, no ATEC radio or multiplex alarms are generated. Contingent on ATEC In-Service Monitoring Set (IMS) scanner configuration, loss of send signal at Schoenfeld (in both Croughton and Pirmasens direction) should be detected during the background scan. Loss of send signals would be reported as a threshold violation to the ATEC node at Schoenfeld.

B. <u>AUTODIN:</u> Both Croughton and the Pirmasens ASCs would experience loss continuity on the 56 KB/S IST, with loss of crypto synchronization and resultant alarm. Assuming traffic in progress between Pirmasens and Croughton, the NCC would get source and destination node timeout reports from both PSN's.

Each PSN's fault detection software would also generate failure reports to the NCC.

The Timout Reports would be incorporated into four NCC Data Management Software data sets:

- Switch timeout status
- Switch disturbance summary (trended)
- Network disturbance summary (trended)
- Node timeout report file

The failure reports are incorporated into four data data sets:

- Network configuration and directory
- Network disturbance summary
- Disturbance suspense
- Failure report file

The reception of a failure report at the NCC will cause the operator to be notified via an audible alarm, and the network disturbance summary will be displayed on the CRT indicating the cause of the report.

V. <u>System Impact:</u> Loss of the Pirmasens-Croughton 56 KB/S IST, interrupts the traffic flow between the two switches. Message queues build at both switches containing traffic destined for users in the Croughton and Pirmasens areas.

VI. <u>Estimated Time to Repair:</u> 1.0 hour, with ATEC assistance in the fault isolation.

VII. <u>Control Actions and Temporary Restoral Possibilities:</u> With the loss of the 56 KB/S IST, little other than altroute action can be implemented pending restoral. The following altroute possibilities exist.

A. Altroute the Croughton-Pirmasens 56 KB/S IST via available spare or pre-empted circuitry.

B. Establish 4.8 KB/S IST via AUTOVON dial up between Croughton and Pirmasens to allow traffic movement until speed IST can be restored.